3X8 ARTILLERY TACTICS: BEFORE, DURING, AND AFTER OPERATION DESERT STORM

A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE

by

HENRY S. LARSEN III, CPT, USA
B.B.A., University of Oklahoma, Norman, Oklahoma, 1982

Fort Leavenworth, Kansas
1994

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3X8 Artillery Tactics: Before, During, and After Operation Desert Storm

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This thesis examines the 3X8 direct support field artillery battalion in the Army's heavy divisions from its inception in 1976 to its present state. The study places special emphasis on documenting the operational change of the firing battery from primarily platoon-based operations before Operation Desert Storm to primarily battery-based operations during and after Operation Desert Storm. The thesis compares platoon and battery-based operations with the Army's initial intent for 3X8 operations, the Army's current doctrinal manuals, and its future artillery systems. The two future direct support systems studied are the M109A6 Paladin System (currently being fielded) and the Advanced Field Artillery System (AFAS). The thesis concludes in determining that platoon-based operations should be the primary method of employing firing batteries in 3X8 battalions both now and with future systems. The thesis makes a number of recommendations to facilitate platoon and battery-based firing battery operations.

3X8, 3X6, 4X6, Battery-Based Operations, Platoon-Based Operations, Split-Battery Operations 109

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

3X8 ARTILLERY TACTICS: BEFORE, DURING, AND AFTER OPERATION DESERT STORM by CPT Henry S. Larsen III, USA, 109 pages.

This thesis examines the 3X8 direct support field artillery battalion in the Army's heavy divisions from its inception in 1976 to its present state. The study places special emphasis on documenting the operational change of the firing battery from primarily platoon-based operations before Operation Desert Storm to primarily battery-based operations during and after Operation Desert Storm.

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The thesis concludes in determining that platoon-based operations should be the primary method of employing firing batteries in 3X8 battalions both now and with future systems. The thesis makes a number of recommendations to facilitate platoon and battery-based firing battery operations.

ACKNOWLEDGMENTS

I could not have written this thesis without the patience, efforts, and support given to me from a number of people.

First, I would like to thank my wife, Pamela, and my children--Blake, Katie, and Julie. Hundreds of hours that I could have spent with them during this school year were sacrificed for this study. They were always supportive and never complained.

Second, I would like to thank my thesis committee members for making this both a challenging and enjoyable adventure. They challenged me to think, provided constructive criticism and insight, and quickly returned all submissions so that I could continue with my work. I know that they also sacrificed many hours in assisting me in this study.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLE

CHAPTER ONE

INTRODUCTION

> The mission of the field artillery is to destroy, neutralize, or suppress the enemy by cannon, rocket, and missile fire and to help integrate all fire support assets into combined arms operations.[1]

Thesis Question

How does the current trend of employing direct support field artillery battalions at the National Training Center affect U.S. field artillery tactics, currently and in the future?

Background

From its beginnings in the Revolutionary War, the United States field artillery has been organized in a battery-based system, that is to say that the firing battery was the smallest tactical formation for the field artillery on the battlefield. Eventually, from the battery formation evolved battalions, and later, the division artillery.

In 1976, the Legal Mix V study was conducted at the U.S. Army Field Artillery Center. The study team's mission was to develop and test improvements in both weapons technology and organizational design for the United States Army field artillery. One area the Legal Mix V study

examined was the improvement of the organizational structure in the division artillery of the Army's heavy divisions.

One of the improvements suggested by the Legal Mix study team was to increase the number of howitzers in a direct support field artillery battalion from eighteen to twenty-four. This increase of six howitzers represented a potential thirty-three percent increase in firepower for the battalion. The study team also recommended that the additional six howitzers be distributed evenly amongst the three firing batteries within the battalion. This recommendation changed the battalion organization from three batteries of six guns (3X6) to three batteries of eight guns (3X8).

In a subsequent study, the Legal Mix V study team tested the employment of the eight-gun firing battery. The study examined five different employment models. The study team recommended that the eight-gun firing battery be employed as two four-gun firing platoons with their own fire direction centers. This recommendation created the 3X8 platoon-based battalion. This recommendation was adopted and changed the basic field artillery firing unit from a battery to a firing platoon in the Army's heavy divisions.

Direct support field artillery battalions started converting from 3X6 battery-based organizations to a 3X8 platoon-based organizations in 1985. This conversion was a small portion of the Army's Division 86 and Army of

Excellence programs. For the field artillery, the change to platoon-based operations represented a significant change in both capabilities and tactics. Besides the thirty-three percent increase in potential firepower, the new platoon-based operations represented a one hundred percent increase in available firing units. The one hundred percent increase is a comparison of the three firing batteries to the six firing platoons now available. From 1986 to 1989, field artillery battalions in the Army's heavy divisions fielded the additional six howitzers and employed the new tactics incorporated in U.S. Army Field Manuals 6-50, Tactics, Techniques, and Procedures for The Field Artillery Cannon Battery and 6-20-1, Tactics, Techniques, and Procedures for The Field Artillery Cannon Battalion. These tactics, stressed in both the doctrinal manuals and within the field artillery community, emphasized platoon-based operations.[2] Also during this period, field artillery batteries fielded the Battery Computer System (BCS) and some Army divisions were receiving the Field Artillery Ammunition Support Vehicle (FAASV). At battalion-level, two Position/Azimuth Determining Systems (PADS) were added to the battalion survey section. The Position/Azimuth Determining System represented a marked improvement in speed over the conventional survey teams that proceeded this system. These changes in tactics combined with the newly fielded equipment represented the Army of Excellence changes to the direct

support field artillery battalions in the Army's heavy divisions.

Platoon-based operations increased a battalion's fire support abilities by enhancing the unit in the areas of flexibility, survivability, responsiveness, mobility, and massed fires.[3] From the inception of 3X8 operations until late in 1990, 3X8 battalions conducted platoon-based operations both at their home stations and at the National Training Center.

During Operation Desert Shield, deployed field artillery battalions started training and employing their firing batteries as eight-gun firing units. Common reasons cited for this change in tactics were ease of command and control; fewer lost units; simplified logistics; less units requiring survey control; and battery survivability. During Operation Desert Storm, all five heavy division artilleries (1st Armored Division, 1st Cavalry Division, 1st Infantry Division, 3d Armored Division, and 24th Infantry Division) employed their field artillery battalions using battery-based operations.

Since Operation Desert Storm, a preponderance of artillery battalions continue to conduct battery-based operations at the National Training Center. This use of battery-based operations continues even though many of the circumstances particular to the Persian Gulf War do not exist at the National Training Center.

The future of the field artillery in the heavy divisions lies with the Paladin M109A6 howitzer and Advanced Field Artillery System (AFAS).[4] Both of these cannon systems have the ability of self-location, directional determination, fire mission reception, and fire direction processing. The field artillery battalions of the future are capable of operating even more decentralized than the current 3X8 platoon-based organization.

The Problem and Its Significance

The problem with units conducting training using battery-based operations is two-fold. The current design of the 3X8 battery supports conducting either platoon or battery-based operations. Units become proficient in the tasks and standards that they train to. Platoon-based operations do pose more command and control challenges than battery-based operations but also offer many advantages.

Battery-based operations are an option for an artillery battery that has suffered combat losses and must consolidate to remain combat effective. Battery-based operations can also be used if a unique situation like Operation Desert Storm presents itself again.

Decentralized operations are the stated future for the field artillery in the Army's heavy divisions. Battery-based operations are more centralized than those of platoon-based operations. Future artillery systems are being

designed to operate with even greater decentralization. Advancements in artillery ammunition capabilities are reducing the need for massed fires from multiple artillery units. Advanced artillery computer systems combined with an increase in firing units will enable artillery battalions to engage more targets effectively.

Our training today must prepare field artillery leaders for all contingencies in a force projection Army. Today's training must also prepare our leaders to command and control the artillery systems of the future.

Purpose

This thesis examines 3X8 operations from its inception to the present. The thesis also examines future artillery organizational requirements and compares those requirements with platoon and battery-based operations. From this analysis of artillery organizations, conclusions are made and recommendations suggested for both current and future operations.

In answering the thesis question, the thesis reviews the effects of battery-based operations on a number of issues. These issues are artillery tactics, techniques, and procedures; leadership development; massing of field artillery fires; movement; future artillery cannon systems; current and future advanced artillery munitions; artillery

gunnery; battalion and battery command and control; and artillery survey.

Subordinate Thesis Questions

There are seven subordinate thesis questions.

Why did the U.S. artillery reorganize its direct support battalions to the 3X8 platoon-based organization? This first subordinate question is answered from research into three primary sources: the U.S. Field Artillery Legal Mix V study; the Army's Division 86 initiative later known as the Army of Excellence program; and information obtained from the Directorate of Combat Developments at Fort Sill. Analysis of the information obtained from these sources determines what objectives the U.S. Army Field Artillery School sought to achieve when establishing platoon-based operations.

What are the U.S. artillery tactics for employing a 3X8 artillery battalion? This subordinate question is answered through research of two primary sources: U.S. Army Field Manuals 6-20-1, Tactics, Techniques, and Procedures for The Field Artillery Cannon Battalion, and 6-50, Tactics, Techniques, and Procedures for The Field Artillery Cannon Battery. Analysis of the information obtained from these sources establishes how the field artillery envisions the employment of 3X8 battalions and batteries.

How were 3X8 artillery battalions conducting operations prior to Operations Desert Shield and Desert Storm? This subordinate question is answered through research into three primary sources: professional articles written about 3X8 employment techniques during this period, the Center for Army Lessons Learned, and National Training Center take-home packages (after-action reports). Research of this question establishes how field artillery units were applying 3X8 tactics prior to Operation Desert Storm.

How were 3X8 artillery battalions employed during Operation Desert Storm? This subordinate question is answered through research of four primary sources: the Center for Army Lessons Learned, numerous professional articles, unit histories, and personal experience. Research of this subordinate question shows if a significant change in artillery employment did occur during Operation Desert Storm.

How are 3X8 artillery battalions currently being employed at the National Training Center? This question is answered through research of three primary sources: the Center of Army Lessons Learned, National Training Center take-home packages, and interviews with field artillery observer/controllers stationed at the National Training Center. Research of this subordinate question establishes how units are currently employing 3X8 battalions.

How does this current employment technique compare with the initial intent and design of 3X8 artillery? This subordinate question is answered by analyzing the results of the previous five subordinate questions. By answering this question, parts of the thesis question are answered, conclusions drawn, and recommendations made.

How does current training in battery-based operations affect the field artillery of the future? This final subordinate question is answered through research into four primary sources: professional articles on the Paladin/Advanced Field Artillery System weapon systems;[4] weapon and ammunition information from the Directorate of Combat Developments, Fort Sill; information provided by the Paladin New Equipment Training Team, Fort Sill; and the 2d Battalion, 17th Field Artillery (Paladin) take-home packages from the National Training Center. Answering this final subordinate question allows for part of the thesis question to be answered, conclusions drawn, and recommendations made on future artillery employment.

Definition of Terms

A 3x6 Battalion: A 3X6 battalion is a field artillery battalion consisting of a Headquarters and Headquarters Battery (HHB), a Service Battery, and three six-gun firing batteries. These firing batteries will conduct battery-based operations. A firing battery in this

organization is organized with one battery headquarters element. The 3X6 Battalion was the direct support field artillery battalion organization in the Army's heavy divisions before the conversion to the 3X8 organization.

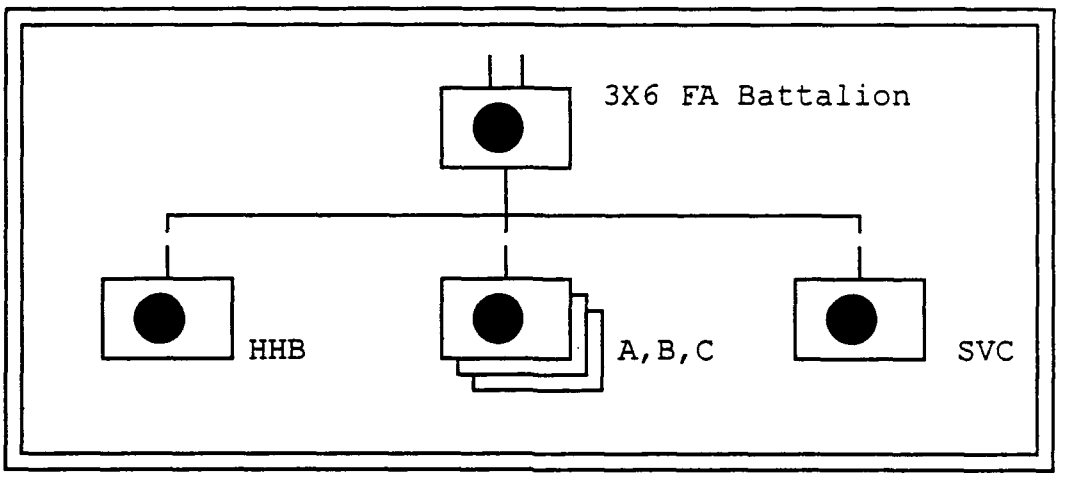

Figure 1: 3X6 FA Battalion Organization

A 3X8 Battalion: A 3X8 battalion is a field artillery battalion consisting of a Headquarters and Headquarters Battery, a Service Battery, and three eight-gun firing batteries. A firing battery in this organization is composed of a battery headquarters and two four-gun firing platoons. Each firing platoon has a platoon headquarters. A firing battery in this organization is designed to conduct platoon-based operations. The 3X8 battalion is the current organization of the direct support field artillery battalions in the Army's heavy divisions.

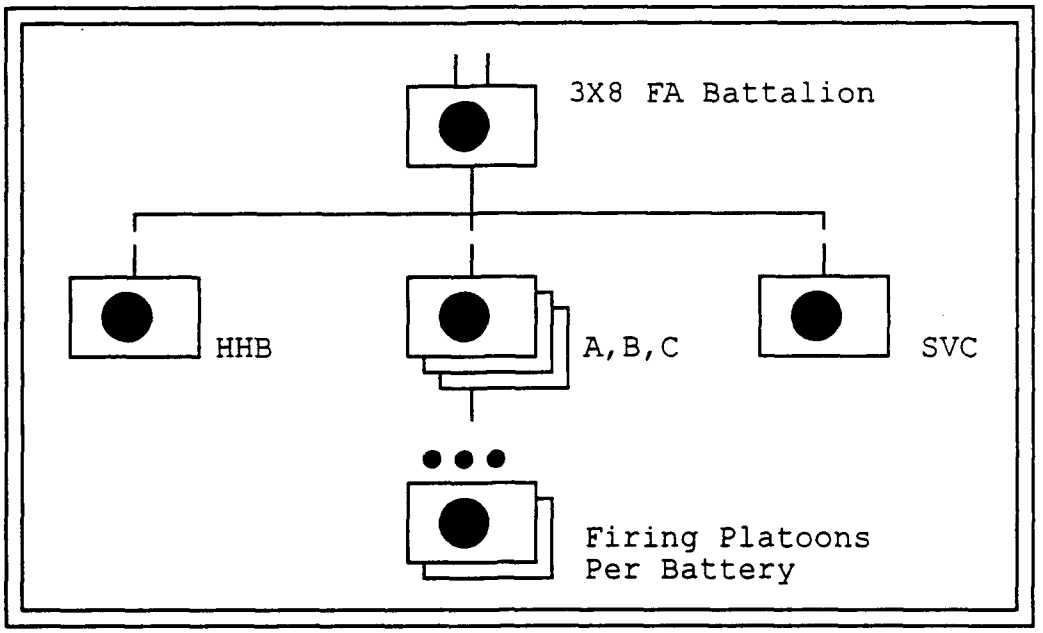

Figure 2: 3X8 FA Battalion Organization

Battery-based Operations: Battery-based operations refer to a unit that moves to and occupies a position as an entire six or eight-gun firing battery. Once occupied, the battery fire direction center controls and fires all howitzers.

Direct Support: A battalion operating in direct support of a maneuver brigade is primarily concerned with the field artillery support needs of that maneuver brigade. Direct support is the most decentralized standard tactical mission.[5]

Doctrine: Fundamental principles by which military forces or elements thereof guide their actions in support of

national objectives. It is authoritative but requires judgment in application.[6]

Five Requirements for Accurate Predicted Fire (APF): Accurate predicted fire is a field artillery standard that units strive for when firing. The five requirements to achieve accurate predicted fires are accurate unit location, accurate meteorological data, accurate weapon and ammunition data, accurate computational procedures, and accurate target location. The firing unit is responsible for four of these five requirements. The fifth requirement, accurate target location, is provided by the source identifying the location of the target such as a fire support team (FIST) or weapons locating radar (WLR). Accurate predicted fires allows a firing unit to obtain first round target effects (without adjustments). This also facilitates massing fires with other firing units that meet the requirements for accurate predicted fires.

General Support: A battalion assigned the general support mission supports the force as a whole and remains under the immediate control of the force artillery headquarters. It is the most centralized of the standard tactical missions.[7]

Platoon-based Operations: Platoon-based operations refer to a unit that moves to and occupies separate positions as two unique platoon formations with four howitzers in each platoon. Once occupied, each platoon

controls and fires its four assigned howitzers by use of two separate platoon fire direction centers.

Procedures: A particular course or mode of action that describes how to perform a certain task.[8]

Reinforcing: Reinforcing is a tactical mission that causes one field artillery battalion to augment the fires of another field artillery unit.[9]

Tactics: The employment of units in combat. The ordered arrangement and maneuver of units in relation to each other/or to the enemy in order to utilize their full potentialities.[10]

Techniques: Techniques refers to the basic methods of using equipment and personnel. Techniques give detail to how commanders actually carry out assignments.[11]

Delimitations

This study is de-limited in that it only examines the direct support field artillery battalion organization found in the Army's armored and mechanized infantry divisions.

The study is limited to only unclassified sources.

Only data from one of the four combat training centers was used. Only National Training Center data was considered relevant to the thesis problem. The Joint Readiness Training Center is not conducting training rotations with heavy divisions. The Combat Maneuver

Training Center (CMTC) is not conducting training rotations with entire field artillery battalions. The Combat Maneuver Training Center is currently only allowing platoon fire direction centers and the battalion tactical operations center (TOC) on its training rotations. The primary reason for not allowing the entire field artillery battalion to train during a Combat Maneuver Training Center rotation is the lack of adequate maneuver space at Hohenfels (Germany) Training Area.

Limitations

Information received from the National Training Center observer/controllers, National Training Center archives, National Training Center take-home packages, and the Center for Army Lessons Learned (CALL) has a non-attribution policy. No mention of specific NTC training units or rotations is made in this thesis or provided to third parties.

The study is also limited by the scarce number of written sources on artillery organizations.

Thesis Structure

To answer the thesis question, the research addresses several issues. These issues are the initial 3X8 goals and objectives; future artillery organizational goals and objectives; and battery-based goals and objectives.

Chapter One provides the background for the research question and its significance.

Chapter Two is a review of significant literature and studies pertaining to the thesis question. Although several books have been used in the research, the preponderance of information collected was found in studies, data bases, and periodicals.

Chapter Three discusses the research methodology used in this thesis. Chapter Four analyzes the information gathered from sources in the literature review. Also used in the analysis is data obtained from sources not mentioned in the literature review. Significant sources of information used in the thesis were the Directorate of Combat Developments and the Gunnery Department, Fort Sill; TRADOC Analysis Command, Command Historian's Office, and the Center of Army Lessons Learned, Fort Leavenworth; National Training Center observer/controllers, Fort Irwin; and the National Training Center Archives, Monterey.

Chapter Five contains a conclusion and recommendations for current and future artillery organizations.

Endnotes

[1]U.S. Army, FM 6-20 Fire Support in the Airland Battle (Washington: Department of the Army, 1988), 2-8.

[2]Major General Raphael J. Hallada, "3X8: Our Force Multiplier," Field Artillery Journal (February 1989): 1.

[3]Ibid., 1.

[4]The Paladin M109A6 and Advanced Field Artillery System howitzers are two new artillery systems designed to replace the current M109A2/3 found in most of the Army's heavy divisions. Additional information on these systems' capabilities is contained in Chapter Two.

[5]FM 6-20 (1988), 2-9.

[6]U.S. Army, TRADOC Pam 34-1 Doctrinal Terms: Doctrine, Tactics, Techniques, and Procedures (Fort Monroe, Virginia: U.S. Army Training and Doctrine Command, July 1984), 3.

[7]FM 6-20 (1988), 2-9.

[8]TRADOC Pam 34-1 (1984), 9.

[9]FM 6-20 (1988), 2-9.

[10]TRADOC Pam 34-1 (1984), 6.

[11]Ibid., 8.

CHAPTER TWO

REVIEW OF THE LITERATURE

In order to thoroughly examine the thesis question, the literature review will present information in five categories corresponding with the subordinate questions.

Literature Pertaining to 3X8 Creation

King of Battle: A Branch History of the U.S. Army's Field Artillery is a historical study by Dr. Boyd L. Dastrup. The study covers the history of the U.S. Army's field artillery from 1775 through 1988. The book also covers European and Colonial field artillery use prior to 1775.

Dr. Dastrup, Fort Sill's current Command Historian, cites the field artillery's change from battery-based to platoon-based operations in the following excerpt:

> the Field Artillery School pursued force structure initiatives because new weapon, command and control, and target acquisition systems were insufficient to readdress the enemy's numerical and firepower superiority and fight the deep battle. Supported by the Legal Mix V Study of 1978, the school sought to improve firepower, survivability, and man-to-equipment ratio by abandoning the six-gun battery in 155-mm. howitzer and 8-inch howitzer battalions for an eight-gun battery. This action, called 3X8 conversion, would give a battalion three, eight-gun batteries rather than three,

> six-gun batteries and expand the number of tubes in a battalion from eighteen to twenty-four. At the same time the new organization would allow creating two, four-gun platoons in each battery and dividing them into separate, semi-independent units to enhance survivability.[1]

The Legal Mix V study was conducted by the Directorate of Combat Developments, Fort Sill and was published in a series of five volumes in 1977. The volumes were originally classified "SECRET" but have since been declassified. The study was conducted in 1976-1977 to determine the future needs of the field artillery in a mid-1980s time frame. One of the issues addressed in the study was the up-gunning of the artillery in the Army's heavy divisions. The study is significant in that it recommended an eight-gun battery organization over the then current six-gun battery organization.

The Legal Mix V study considered thirty-six separate mixes of division artillery groupings. Mixes included direct support battalions of six and eight guns per battery and three to five batteries per battalion (i.e., 3X6, 3X8, 4X6, 4X8, 5X6, and 5X8). These mixes were run through two separate war gaming models against a Soviet threat scenario in a North Atlantic Treaty Organization (NATO) environment. Mixes were evaluated and compared to each other on three criteria. The criteria used were combat effectiveness, unit cost effectiveness in combat, and cost to maintain the unit over a period of ten years.

The Legal Mix V study recommended a number of eight-gun battery mixes over six-gun battery mixes in the modeling results. The study does not mention or initially make a recommendation on platoon-based versus battery-based operations or organizations. At the time of the initial Legal Mix V study, the model used by the Directorate of Combat Developments did not focus down to platoon resolution.

An earlier study conducted by the Legal Mix V study team did analyze platoon-based and battery-based artillery organizations to determine which would be a more effective organization. "Artillery Support for the Restructured Heavy Division, 1981" was a draft study by the Legal Mix V study team to determine what battalion organization would serve the artillery best in a 1980s time-frame. The study looked at five different type mixes. Those mix types are outlined in figure 3.

	No Bns Per Div	No Btrys Per Bn	No M109A1's Per Btry/Bn	Fire Units	FDC's Per Btry
Mix 1	3	3	6/18	1	1
Mix 2	3	4	8/32	2	1
Mix 3*	3	4	8/32	2	2
Mix 4	3	4	8/32	1	2
Mix 5	3	5	6/30	1	1

Figure 3: Legal Mix V Study Team DS Battalion Mixes[2]

Mixes one, four, and five are battery-based organizations. *Mix three is a 3X8 platoon-based organization. Mix two is a hybrid of platoon and battery-based organizations with the unit operating firing platoons at two separate firing positions but firing the platoons simultaneously under the control of one fire direction center. For the purposes of the thesis, mixes one, three, four, and five are applicable.

The study tested the different organizations using two computer simulations in a NATO environment against a Soviet threat. The organizations occupied using standard and terrain-gun positioning techniques.[3] The study considered the effectiveness of the organizations in two broad areas of cost analysis and survivability analysis. Mix three, the platoon-based organization, performed best in the area of cost analysis. The cost analysis compared the targets defeated during a period of time versus unit losses. Figures four through six show results from the legal mix study over a 24-hour period.

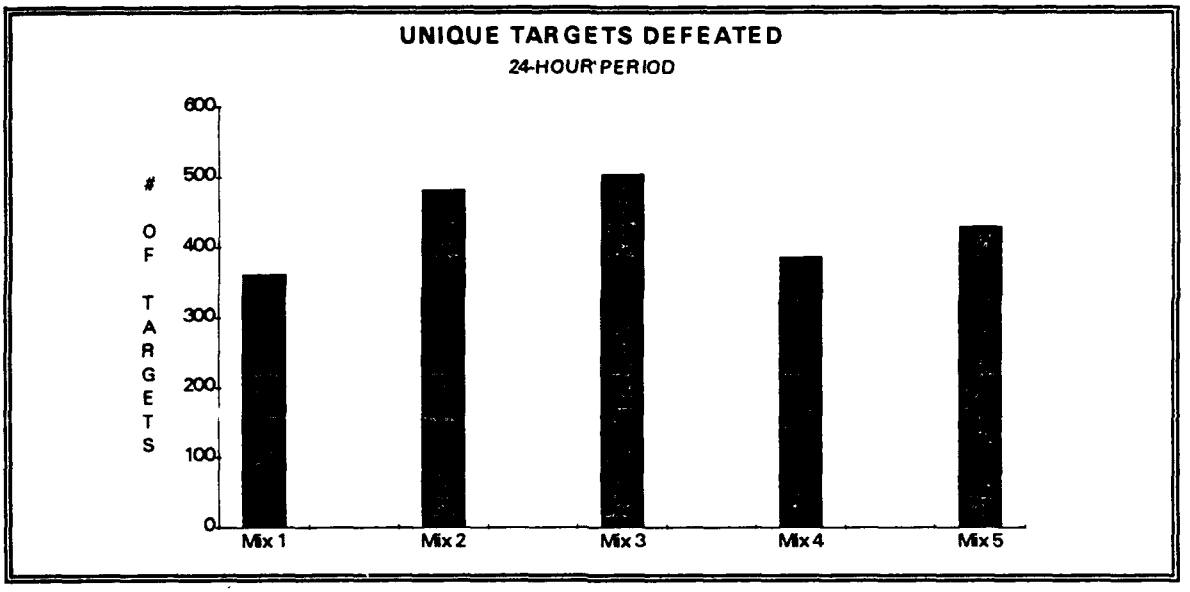

Figure 4: Unique Targets Defeated over a 24-hour Period[4]

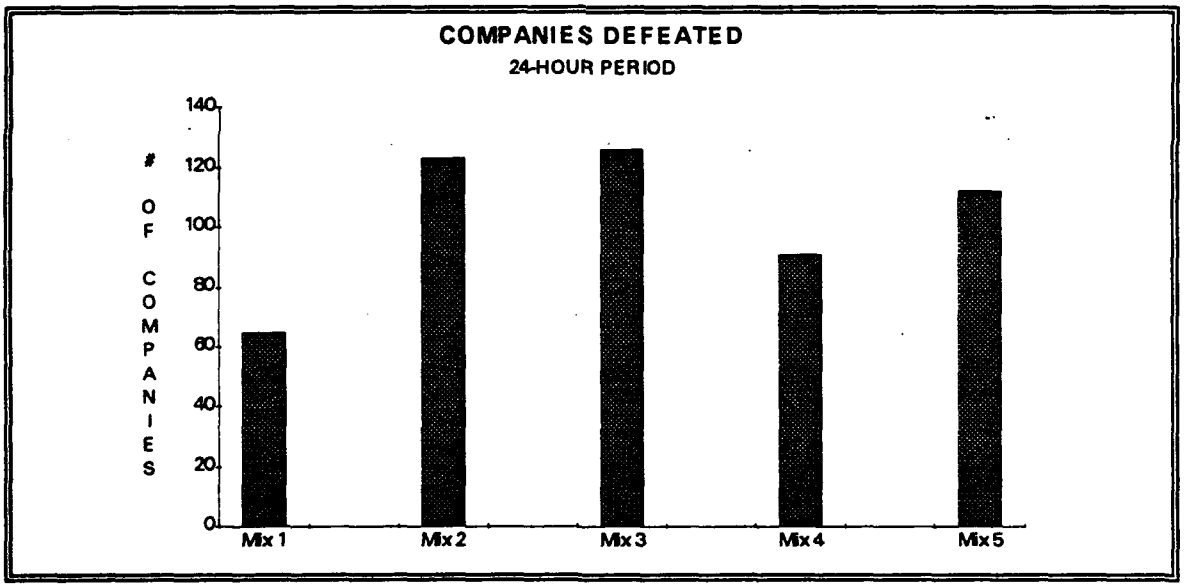

Figure 5: Number of Companies Defeated over a 24-Hour Period[5]

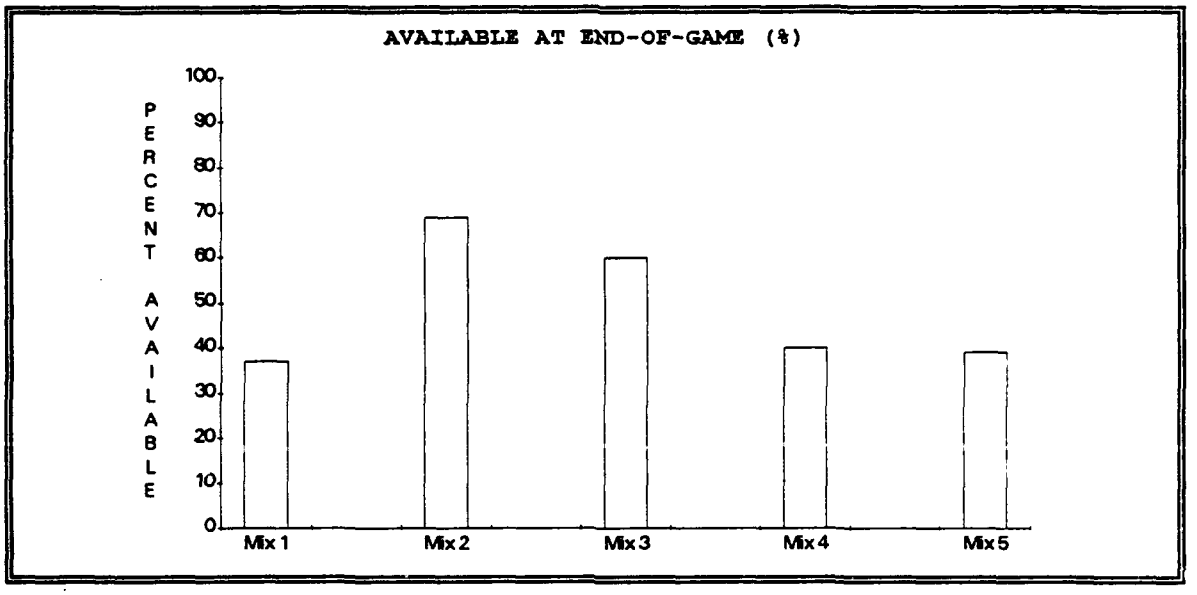

Figure 6: Percent of Unit Available over a 24-Hour Period.[6]

Figure seven shows the results of the legal mix study analyzing firing units survivability over a 24-hour period. The threat wargamed was Soviet-style counterbattery tactics.

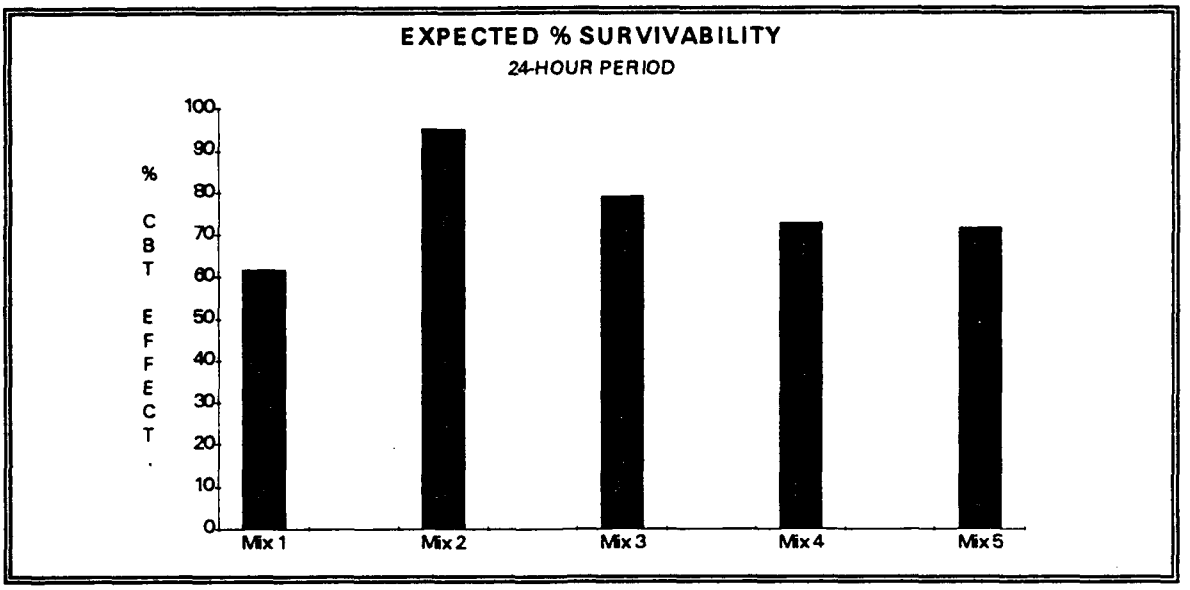

Figure 7: Expected Percentage Unit Survivabilty.[7]

The results of this legal mix study were:

> The best organization, of those alternatives examined, for the direct support battalion in the reorganized division consists of 3 battalions equipped with the M109A1 howitzer having 4 batteries per battalion and 8 guns per battery deployed as two 4-gun fire units each having its own fire direction center.[8]

This recommendation led to the approval of split battery operations. Later the 3X8 battalion would be fielded in the Army's heavy divisions with three firing batteries per battalion vice the four firing batteries the study team recommended.

The Army of Excellence: The Development of the 1980's Army by John L. Romjue is a historical study of the Army's transition from the Reorganization Objective, Army Divisions (ROADS) in the 1960s through Division 86 to the Army of Excellence in the late 1980's.[9] The study is of

interest in that it addresses in depth the issues and leaders involved in changing the Army's division designs in the mid-70's and 80's. The changes in the Army's divisions during this time frame also included the upgunning of the direct support battalions from eighteen to twenty-four howitzers. Romjue cites these changes to the division's artillery several times in the book, however, he does not go into any great detail on the conversion from battery-based to platoon-based operations and its significance.

Literature Pertaining to 3X8 Operations Before Operation Desert Storm

The February 1989 issue of the Field Artillery Journal addressed the fairly recent concept of 3X8 battalions (units began fielding in 1985). Major General Hallada, then commandant of the Field Artillery Center, wrote an introductory article titled "3X8: Our Force Multiplier." He emphasized the importance of 3X8 operations and what these operations brought to the AirLand battlefield:

> The concept of 3X8 operations emphasizes the five fundamentals of fire support in the AirLand battle: flexibility, responsiveness, mobility, survivability, and massed fires.[10]

The main benefit that Hallada stressed was that 3X8 operations provided the maneuver commander six firing units instead of three. This doubling of firing units allowed for benefits in the areas of flexibility, responsiveness,

mobility, and survivability. Flexibility is obtained by having more units to position on the battlefield and to call upon to fire. Responsiveness is increased because more targets can be serviced by six firing units versus three.

Hallada stated mobility was increased based on two advantages to 3X8 operations. One advantage was that six firing platoons increased the number of firing units that would be in position to fire at any given time. The second mobility advantage was that the streamlined design of the firing platoons consisting of "'pure shooters' with no administrative vehicles slowing the battery's combat movement"[11] would minimize the time that units were displaced from firing positions. Survivability was increased in platoon-based operations based on the platoon's "smaller size and the corresponding footprint they portray to enemy target acquisition and counterfire assets."[12]

Massing of fires was improved in 3X8 operations for two reasons. The first reason was the increase by thirty-three percent more guns in the 3X8 battalion over the 3X6 battalion. The second reason was because of the then recently fielded Battery Computer System (BCS) in the platoon fire direction centers.

As the Chief of the Field Artillery, Hallada's article was important for a number of reasons. First, his article stressed to the field artillery community that 3X8 operations were platoon-based operations. Not once in the

article did Hallada mention employing firing units as entire firing batteries. Second, he saw platoon-based operations as "a major step towards autonomous firing operations"[13] in his reference to the howitzer improvement program (later the M109A6 Paladin) and the Advanced Field Artillery System (AFAS).

A second professional article in the same issue of the Field Artillery Journal is an example of how the field artillery was employing 3X8 batteries before Operation Desert Storm. "3X8 Matures for Pathfinder Power" is an account of 3X8 operations in the 8th Infantry Division Artillery written by the divarty commander, Colonel Pickler, and the division artillery operations officer, Major Gay. The article was written in late 1988, about three years after the division fielded the additional six howitzers in its direct support field artillery battalions. This division artillery had its full complement of additional equipment to include two Position/Azimuth Determining System (PADS) vehicles, battery computer system equipped fire direction centers, and the Field Artillery Ammunition Support Vehicle (FAASV).

The authors stated that 3X8 operations improved the field artillery's fire support in three areas: flexibility and survivability, lethality, and logistics. The reason for these improvements are seen in the following statement about 3X8 operations:

> It's important to note that the basic scheme of Field Artillery maneuver doesn't change dramatically; what does change is that 3X8, for the first time, offers us a command and control system that allows us to do what we have advertised for years: split-battery operations.[14]

The authors cited many similar survivability and flexibility issues as Hallada. They pointed out that seventy-five percent of the German towns and villages that the division artillery occupied with four-gun platoons would not support a six-gun firing battery. This increase in potential firing positions increased the battalion operation officer's (S-3) planning flexibility. Also, occupying these urban sites increased the survivability of the firing platoon.

The authors stressed that lethality was increased by the number of firing units the battalion had in position to fire at any one time. By "leapfrogging" platoons, the battalions always had at least fifty percent of the firing platoons (twelve guns) in position to fire. This is in contrast to moving by battery, where you can have either thirty-three percent of the guns in position (eight guns) or sixty-seven percent of the guns in position (sixteen guns).

The 8th Infantry Divarty article is significant in that this unit was conducting its operations just like Hallada's article stated 3X8 units should be operating. Both articles stressed the importance of conducting platoon-based operations and mentioned leapfrogging platoons to keep

fifty percent of a battalion's firepower in position ready to fire. In the area of lethality, both articles cited that the additional firing units provided the maneuver commander the ability to engage more enemy units on the battlefield.

"Operations Implications of 3X8 Field Artillery Battalions" by Captain Buzon is a Naval Postgraduate School thesis designed to provide some quantitative analysis on perceived shortfalls in 3X8 operations. The author cited in the introduction of the thesis that there is a firepower problem being observed at the National Training Center with the 3X8 battalions. The observer/controllers at the National Training Center not only had not seen any significant increase in firepower based on the up-gunning of the 3X8 battalions, but they were actually observing "a decrease in the observed effectiveness of artillery during battles witnessed at NTC."[15]

Possible causes the author cited for this decrease in artillery firepower under the 3X8 platoon-based organization are lack of massing; command and control of fires; battery leadership responsibilities; human factors issues of automated fire control; and Joint Munitions Effects Manual (JMEM) arguments. The observer/ controllers' primary stated reason for the lack of artillery effectiveness was

> ...[the 3X8 units] would have greater effect if, [instead of trying to engaged multiple targets with

> platoon fires], they would just pick one target and shoot the entire battery....[16]

In support of these observer/controller contentions, Buzon sought to compare the effects of two platoon firing units firing missions autonomously to those of an eight-gun battery firing missions as one unit.

The thesis compared the two autonomous four-gun platoons with the one eight-gun firing battery using the Janus computer simulations model and ten separate scenarios. The results of the ten scenarios showed no significant difference between the two employment techniques in the area of firepower. In fact, the author contended that the differences between model scenarios and performance are due to environmental factors surrounding the battle and intangible, unit-oriented factors such as training; unit proficiency; commander's intent; level of execution; command and control; communications; and innumerable other factors.[17]

The thesis concluded that the National Training Center observation that "eight is better than four" could not be substantiated. The author also concluded that further research should be performed in the area of 3X8 organizational effectiveness.

U.S. Army Field Manual 6-50, Tactics, Techniques, and Procedures for the Field Artillery Cannon Battery is the field artillery base manual for how cannon firing battery operations should be conducted. The manual was updated on

20 November 1990 prior to Operation Desert Storm but five years after 3X8 platoon-based organizations began being fielded in the Army. The update of the manual reflected the changes in the employment of eight-gun batteries using the firing platoon employment method. The manual is significant to the thesis in that it states the approved tactics, techniques, and procedures for both a platoon-based and battery-based field artillery organization.

Chapter One of FM 6-50 is about the mission, organization, and key personnel of a field artillery cannon battery. It divides the chapter into distinct sections for cannon batteries in both platoon-based and battery-based units. A caveat to how a battery should be employed is provide on page 1-1 of the manual:

> The field artillery cannon battery is the basic firing element of the cannon battalion regardless of how the battery is structurally organized. The battery's capability is enhanced through the flexibility and survivability provided under an organization based on platoons. In no way should the references to platoon- or battery-based organization be construed as the structure for operational employment. Rather, the terms pertain solely to organizational structure.[18]

On the same page, however, is the following guidance on the employment of field artillery batteries:

> Organizational structure does affect employment. In a unit organized with a single six-gun battery, the battery is necessarily employed as a single unit under the direct control of the battery commander. In a platoon-based unit, the battery may be employed in one of the following ways:

* As two platoons under the control of the battery commander.

* As a single unit, with platoons merged.

* As two independent platoons directly controlled by the battalion S3, through the BC, with the battery commander providing reconnaissance, selection, and occupation of position (RSOP) and logistical support. This last employment option is the least desirable. It is used only when the tactical situation permits no other means of command and control.[19]

Field Manual 6-50 cites numerous examples of unit actions, both battery and platoon-based, throughout the manual. In examples for occupying a new position, the manual shows a four-gun platoon using terrain gun positioning; a four-gun platoon using a diamond formation; and a six-gun battery using a star formation. In the chapter covering battery defense, all four visual diagrams/defense sketches depict a four-gun platoon. In fact throughout Field Manual 6-50, there are eight four-gun platoon examples, three six-gun battery examples, and one eight-gun battery example. The one example of an eight-gun firing battery is in the communications chapter.[20] The figure depicting an eight-gun firing battery shows the communications wiring diagram for a platoon-based battery using only one battery computer system (i.e. one available fire direction center instead of the authorized two).

Field Manual 6-50 does not cover any tactics, techniques, and procedures for a consolidated eight-gun battery. Except for the aforementioned example in the

communications chapter, Field Manual 6-50 does not address battery operations in the degraded mode. Field Manual 6-50 also does not mention when, if ever, a platoon-based battery should be consolidated into a single firing unit. This absence of guidance includes Appendix F Special Operations. The special operations appendix covers artillery operations in the mountains, jungles, northern (arctic), urban, and desert environments. The appendix covers different artillery considerations for the different environments, but does not suggest the consolidation of platoons for any specific environment or mission.

Literature Pertaining to 3X8 Operations During Operations Desert Shield and Desert Storm

There are several articles written by former divarty and battalion commanders concerning 3X8 operations during Operations Desert Shield and Desert Storm. Articles from the 1st Infantry Divarty, 1st Cavalry Divarty, 3d Armored Divarty, and 24th Infantry Divarty, show that these units were conducting battery-based operations for the first time during these two operations. Analysis of these articles will determine the reasons, both similar and different, for why these units reverted to battery-based operations.

The "1st Cav Div Arty: Report from Operation Desert Shield" article was written by the divarty commander, Colonel Gass. The article was written prior to Operation Desert Storm and published just before the ground war

commenced. Gass stressed the need to conduct a different kind of 3X8 operations by operating the firing batteries as "single units instead of platoons"[21], i.e. battery-based operations. Reasons cited for conducting battery-based operations were a reduced threat capability to acquire firing units; command and control issues; simplified logistics; fewer units aid in massing fires; and fewer units requiring survey.

The command and control issues pertained to the movement of the entire battery under the battery commander's control reduced the problems of lost units. Very few maps were available to the units and those that were available were 1:250,000 scale. Fewer firing units eased the problems of ammunition and fuel distribution. Fewer firing units also reduced the requirements for survey control and, according to Gass, allowed the battalions to mass fires better than six separate firing platoons could. By operating as a larger battery-based firing unit, the battery was less vulnerable to ground attack and did not run a significant risk to counterbattery fires from the diminished Iraqi threat.

The "Victory Artillery in Operation Desert Shield" article is an account of how 24th ID Divarty trained in preparation for Operation Desert Storm. The author, Colonel Rolston, was the division artillery commander for the unit. He stated in the article that the change to battery-based

operations was not because of the situation in Saudi Arabia but "the result of a number of rotations through the National Training Center."[22] He stated that at the National Training Center

> ...we went to the extreme tactically. Instead of a battalion of three batteries, each with two platoons, we operated more like a battalion with six firing "batteries". The platoons were often widely separated - sometimes by 10 kilometers or more. Units moved by platoons rather than batteries, which exacerbated any problems we had.[23]

By conducting battery-based operations, Rolston cited the following benefits: command and control; logistics; and massing of fires. He also mentioned that battery-based operations compensated for the level of training and experience of the platoon leaders within the division artillery. Rolston also took into account enemy threat when making the decision to move his batteries in "more or less one huge firing formation."[24]

Rolston's article is reinforced by Lieutenant Colonel Floris' article, "1-41 FA in Desert Storm: A Test Bed for Doctrine and Equipment," about 24th Infantry Division Artillery's operations during Operation Desert Storm. Floris commanded a direct support artillery battalion in the 24th Infantry Division during Operations Desert Shield and Desert Storm. He cited command and control, security, movement, and timely execution of fires as the reasons for using battery-based operations over platoon-based operations.

The 24th Infantry Division Artillery conducted battery operations much in the same manner as the 1st Cavalry Division Artillery in that "Platoons never traveled more than 500 meters apart during the conflict and operated with one platoon fire direction center...."[25] The batteries moved in the desert wedge which made movement fast and facilitated in the battalion conduct of hasty occupations. Using this wedge formation, the battalion "routinely occupied and was safe to fire in less than eight minutes while still meeting the requirements for accurate predicted fires."[26]

"Reflection on the Storm: FA Vector for the Future" is an article written by Lieutenant Colonel Davis about his battalion's experiences during Operation Desert Storm and where he thinks the field artillery needs to go in the area of future operations. Davis was a battalion commander in the 3d Armored Division Artillery during Operation Desert Storm. Like the 1st Cavalry Division and 24th Infantry Division, the 3d Armored Division Artillery used battery-based operations over platoon-based operations. "An early victim of the desert war was the 3X8 concept of employing batteries in distinct platoons."[27]

Reasons given for converting to battery-based operations were that it facilitated mass fires; simplified command and control; reduced position coordination with brigade; eased logistical support; and enhanced local

security. He also recommended using 4X6 employment for the future Paladin system instead of the 3X8 platoon-based system that is planned.

"In the Wake of the Storm: Improving the FA After Operation Desert Storm" is an article written by Lieutenant Colonel Lingamfelter who was serving as the 1st Infantry Division Artillery executive officer during Operation Desert Storm. This article cited advantages in command and control and massing of artillery fires as the two primary reasons for movement by battery instead of platoon. The author cited that massed artillery fires "(not less than a battery)"[28] got the best effects as opposed to servicing a lot of targets using the platoon-based concept.

In the area of command and control, he argued that platoon operations "complicate an already brittle command and control environment."[29] The article continued with the assertion that movement by battery "works best". Reasons for battery movement were that the battlefield was already crowded without individual firing platoons competing for space. Also, that individual platoons were more vulnerable to bypassed enemy than entire firing batteries; and unexploded ordnance "require careful route reconnaissance and convoy control by the battery commander."[30]

Literature Pertaining to 3X8 Operations After Operation Desert Storm

"Analysis of the Field Artillery Battalion Organization Using a Markov Chain" is an unpublished Naval Postgraduate School thesis by Captain Finlon. This thesis compared the organizational effectiveness of a 3X8 direct support battalion (platoon-based) with a 4X6 direct support battalion (battery-based). The one discriminator used in the thesis to compare the two organizations was the number of weapons available for firing based on the movement possibilities and potential that each type of unit possessed. The better unit being the one that had the most howitzers in position to fire and the least number of howitzers on the move. The author compared the two organizations with a "simple" computer model using a continuous time Markov chain.[31]

Finlon's introduction of the two different organizations listed the "main feature of the 3X8 structure is that it allows the battery to conduct split-battery operations."[32] The thesis stated that there were several advantages the 4X6 organization possessed over the 3X8 organization to include additional flexibility. The author anticipated the 4X6 structure to perform better than the 3X8 structure in the computer model.

The model compared the two organizations ability to provide fire support based on total number of howitzers in

position ready to fire. To keep the model simple, only howitzers that were moving were not available for firing and no other possibilities such as maintenance failures or combat losses were considered. The author ran his model through eight scenarios--movement to contact, deliberate attack, exploitation, defense of the Main Battle Area (MBA), delay, reinforcing a movement to contact, reinforcing an exploitation, night movement to contact, and night exploitation.

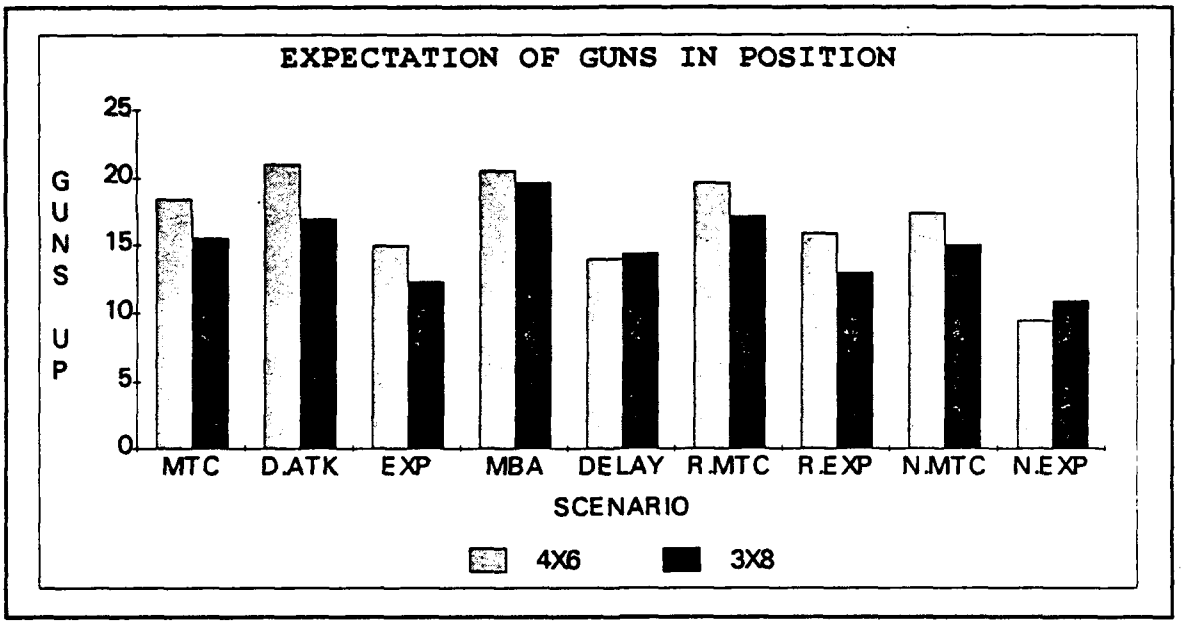

Figure 8: The Long-Run Expectation of Guns in Position[33]

The 4X6 battalion performed better than the 3X8 battalion in six of the eight scenarios. The two organizations are equal in effectiveness in the delay

mission; and the 3X8 battalion performed better than the 4X6 in the night exploitation. The author concluded that based on the criteria of howitzers available to fire that the 4X6 organization is superior to the 3X8 organization.

One glaring error in the model was the potential movement scenarios the author allowed for the two types of organizations. For the 3X8 battalion, the study allowed for the unit to move by platoon or battery. This standard is realistic since moving by elements smaller than platoon-size is fairly rare in training and in combat. This allowed in the 3X8 model seven probabilities for howitzers in position (0,4,8,12,16,20, and 24 howitzers). The author allowed the 4X6 battalion to move by battery or by platoon. This "platoon of guns" would be a two-gun subset of the battery. This allowed in the 4X6 model thirteen probabilities for howitzers in position (2,4,6,8,10,12,14,16,18,20,22, and 24 howitzers).[34]

Two problems exist with the movement assumptions made in this thesis. One problem is that the situation of moving two guns happens as often as moving the entire battery--it does not. A second problem is assuming that the 3X8 organization can not perform this same capability.[35] In fact, a 3X8 organization has more leadership and wheeled escort vehicles available to support a two-gun movement than that of a 4X6 organization.

Literature Pertaining to Future Artillery Operations

Special Text 6-50-60, Tactics, Techniques, and Procedures for the M109A6 (Paladin) Howitzer Section, Platoon, Battery, and Battalion is a student text published the U.S. Army Field Artillery School. The manual is significant to this thesis for two reasons. The first reason is that it provides the current employment techniques and capabilities of this next generation direct support howitzer. Second, the manual is the primary reference currently being used by the Paladin New Equipment Training Team for the fielding of this system. The Paladin howitzer is currently only fielded in one field artillery battalion (2d Battalion, 17th Field Artillery), but is scheduled to be fielded in a number of the Army's active duty heavy divisions and the National Training Center over the next five years.

The Paladin howitzer system is the fourth product improvement to the original M109 self-propelled howitzer.[36] The primary advantages the Paladin possesses over the M109A2/A3 are:

1. Extended firing ranges.

2. Self-determination of position (easting, northing and altitude).

3. Self-determination of direction/azimuth.

4. Capability of accepting a fire mission, computing the technical fire control solution, and slewing the cannon to the proper elevation and deflection.[37]

5. Shorter occupation time (75-120 seconds) which require no support from battery personnel and equipment, i.e., platoon leaders, gunnery sergeants, aiming circles.

The Paladin is similar to the M109A2/A3 howitzer in a number of areas to include:

1. Mobility/rate of march is identical.

2. Rates of fire are identical.

3. Ammunition storage capacity is nearly identical.

4. Both systems are supported by the same ammunition carrier.

Special Text 6-50-60, like Field Manual 6-50 and Field Manual 6-20-1, stresses operating the Paladin battalion in a 3X8 platoon-based organization. The battalion organization for the Paladin system (TOE 06-365-L) is virtually identical to the M109A2/A3 3X8 battalion currently fielded in the Army's heavy divisions (see Figure 2).[38] Special Text 6-50-60 mentions two methods of employing the Paladin system, by platoon (four guns) or by pairs (two guns under platoon control). The paired employment is the preferred method of the two employment methods.[39] The manual continues to emphasize platoon operations by mention of platoon position areas of 1000 X 2000 meters when planning for positioning of the battalion (by the operations officer) and the battery (by the battery commander). Within these platoon position areas the Paladin platoon will conduct it own survivability moves under platoon control.

Professional articles and Army manuals stressed the 3X8 platoon based organization offered the advantage of keeping fifty percent of a unit's firepower in place by leapfrogging platoons behind maneuver elements. Special Text 6-50-60 states that this technique is no longer necessary.

> the DS battalion does not necessarily have to "leapfrog" batteries or platoons in order to keep a firing capability with the maneuver element. Platoons can move along, keeping pace with their supported unit and still be able to provide near instantaneous field artillery support.[40]

Transition of Future Cannon Artillery Study-II (TOFCAS-II) is a study on the Paladin and AFAS systems conducted for the Department of the Army by Military Professional Resources, Inc. The TOFCAS-II study analyzed results from the Paladin's Follow-On Operational Test and Evaluation (FOTE) and made recommendations for the employment of the Paladin system as well as the future Advanced Field Artillery System and currently fielded M109A2/A3 howitzer system.

> The TOFCAS-II study team's focus was to use the Paladin FOTE as a vehicle to examine the seven basic tasks a field artillery battalion must perform to support a maneuver force in relation to the TRADOC domain of Doctrine, Training, Leader Development, Organizations, Material and Soldier Performance and in context of the organizational elements ranging from individual through battalion level.[41]

The Follow-On Operational Test and Evaluation of the Paladin system was conducted at Fort Sill using a four-gun

platoon in November 1992. The platoon conducted the evaluation using tactics, techniques, and procedures outlined in ST 6-50-60. After an initial twelve-week train-up, the platoon conducted five live-fire field exercises based around a replicated threat environment founded on European Scenario Oriented Recurring Evaluation System (SCORES V) Scenario and Test Threat Support Package.[42] During the FOTE train-up and evaluation, the Paladin platoon fired over 25,000 rounds of 155mm ammunition. The Follow-On Operational Test and Evaluation is the primary evidence used by the TOFCAS-II study team in conducting their analysis and making their recommendations. The study team used the FOTE results and compared these results to existing field artillery doctrinal manuals and Special Text 6-50-60. Although the TOFCAS-II study made numerous recommendations on the Paladin, Advanced Field Artillery System, and M109A2/A3 systems, the most significant recommendations for the purpose of this thesis were in the areas of organizational design, doctrine, massing of fires, and leadership development.

In the area of field artillery doctrine, the study concluded that no significant changes need to be made to the current existing field artillery doctrinal manuals due to the new Paladin system and its capabilities. The study also commended the Special Text 6-50-60 as an "excellent" initial effort and recommended it as the base manual for the new

Paladin units to use in the field. The study recommended that the Special Text 6-50-60 be updated based on unit experiences and recommendations from 2d Battalion, 17th Field Artillery generated by the unit's continued field use of the system and rotations to the National Training Center.

The field artillery organization recommended by the Army during the Follow-On Organizational Test and Evaluation was the platoon-based system found in the 3X8 battalion. The TOFCAS-II study mentioned that "the Army examined in great detail this basic firing element - the platoon"[43] and "results of the FOTE confirmed that this organization could function as intended and provide the necessary fire support...."[44] The TOFCAS-II study did examine the 3X6 and 4X6 battery-based battalion organizations as possible alternative organizations. The study concluded that both of these organizations could be used for employing the Paladin system but had drawbacks when compared with the 3X8 platoon-based organization. The 3X6 battalion could offer savings in personnel and equipment cost but would have significantly less firepower and flexibility when compared to the 3X8 battalion. The 4X6 battalion organization has the same firepower potential as the 3X8 battalion but would have higher operating overhead costs associated with an additional battery organization and less flexibility than the 3X8 battalion organization. The TOFCAS-II study concluded that the 3X8 Table of Organization and Equipment

outlined in Special Text 6-50-60 was the correct and best organization for the Paladin system.

The Paladin offers increased opportunities for massed fires based on increased ranges and mission response times from the move the Paladin possesses over the M109A2/A3. The increased range of the Paladin allows for a greater common area for all firing elements within the battalion to fire on. The ability to stop and fire within 75-120 seconds of mission receipt allows for a battalion to mass all firing units if desired. The Paladin possesses the same rates of fire as the M109A2/A3 and does not possess any special program to ensure simultaneous or near simultaneous arrival of field artillery munitions on a target area. The simultaneous or near simultaneous arrival of munitions on a target area is a critical component of terminal effects. The initial volley of artillery fire is more effective than the subsequent volleys due to the change in the target's disposition between volleys. An example of a change in target disposition would be troops standing during the initial volley then improving their disposition by moving to the prone position and seeking cover before subsequent volleys impacted. A battalion firing one volley (24 rounds) is more effective than a platoon firing six volleys (24 rounds). This is true for the Paladin system as well as the M109A2/A3 howitzer.

The TOFCAS-II study also made recommendations on the future Advanced Field Artillery System in the areas of system capabilities and integration of the Advanced Field Artillery System into the Army. Just as the Paladin howitzer system represented an evolutionary change over the M109A2/A3 howitzer; the TOFCAS-II study team recommended that the Advanced Field Artillery System must be a revolutionary change in capabilities over the Paladin system. To be an evolutionary change in artillery capabilities, the Advanced Field Artillery System must be capable of:

1. Knowing precisely where it is relative to everyone else on the battlefield.

2. Knowing precisely where it is pointing.

3. Talking to other systems on the battlefield.

4. Shooting in near-real time and further with precision.

5. Loading itself based on mission requirements.

Even with the above listed changes, the TOFCAS-II study team suggested that the Advance Field Artillery System could be employed using the same battalion organizational design and tactics, techniques, and procedures outlined in ST 6-50-60 for the Paladin howitzer system. The main reason for keeping a standard organizational design for the Paladin and Advanced Field Artillery System can be seen in figure nine.

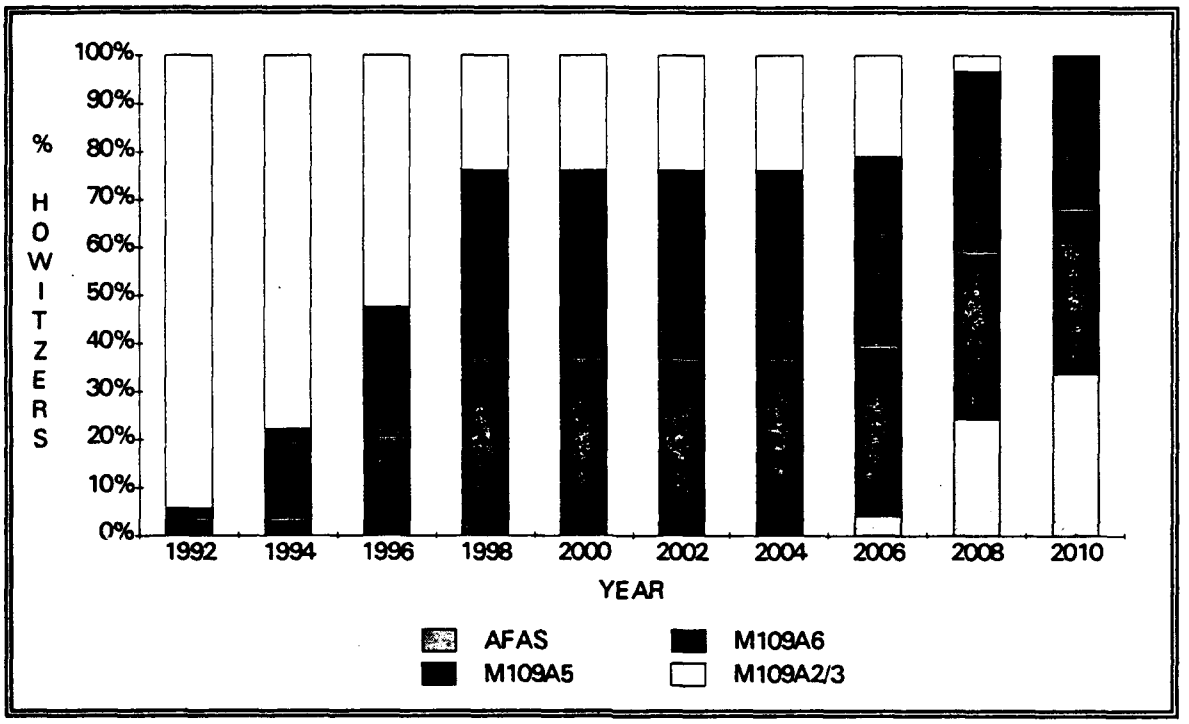

Figure 9: Field Artillery 155mm Howitzer Laydown[45]

Over the next sixteen years, the field artillery will have two and then three significantly different howitzer systems in direct support of the Army's heavy divisions. Assuming that the Army will continue with its personnel management system of rotating officers and noncommissioned officers every two to three years, the Army would have a very significant training problem if the organizational designs of these units were not similar.

The Final Draft Operational Requirements Documents (ORD) for the Advanced Field Artillery System (AFAS), and Future Armored Resupply Vehicle (FARV) is a Department of

the Army memorandum dated 14 June 1993 from the Commandant, U.S. Army Field Artillery School to the Commander, U.S. Army Training and Doctrine Command. This forty-three page memorandum states the desired operational requirements for the Advanced Field Artillery System and its primary supply vehicle. The document is significant to this thesis in that it will be used in establishing the projected capabilities of the Advance Field Artillery System. The Advanced Field Artillery System is currently a fully-funded project with howitzers to be fielded into units starting in 2005.

Besides listing the operational requirements for the Advanced Field Artillery System, the memorandum also justified these requirements in Annex A; establishes the operational mode summary/mission profile in Annex B; and states training support requirements in Annex E. Significant increases in the capabilities of the Advanced Field Artillery System over the Paladin and M109A2/A3 howitzer systems will exist once the Advanced Field Artillery Systems is fielded based on the requested capabilities. Table One lists some of the increased capabilities the Advanced Field Artillery System is projected to have.

Table 1

Advanced Field Artillery System Projected Capabilities.

Advanced Field Artillery System Capabilities	
Maximum Range (unassisted):	40 kilometers
Maximum Range (assisted):	50 kilometers
Max Rate of Fire:	10-12 rounds per minute for the first 3-5 minutes
Sustained Rate of Fire:	3-6 rounds per minute
Simultaneous Impact Mission Capability:	4-8 rounds all impacting within 4 seconds
Sustained Highway Speed:	40-48 MPH
Sustained Cross-country Speed:	23-29 MPH
Crew:	3 personnel
On-the-move Fire Mission Response Time:	30-45 seconds
In-position Fire Mission Response Time:	15-20 seconds

The Advanced Field Artillery System and Future Armored Resupply Vehicle Firing Battery, Platoon, and Section White Paper Tactics, Techniques, and Procedures (for purposes of this thesis and brevity will be referred to as the AFAS White Paper) is a Department of the Army contracted study on the future employment of the Advanced Field Artillery System. The AFAS White Paper, completed 30 July 1993, is significant to this thesis in two areas. The first area is in the capabilities of the Advanced Field Artillery System and best methods in employing its advancements. The second area is the increase in duty requirements and responsibilities to be placed on platoon leaders, platoon sergeants, platoon gunnery sergeants, and howitzer section

chiefs because of the new technological advances in the Advanced Field Artillery System and the decentralized operations the AFAS White Paper suggested are necessary.

The AFAS White Paper listed four possible battalion organizations for the Advanced Field Artillery Battalion. These organizations are similar to the battery and platoon-based organizations that already exist in the field artillery today. The suggested organizations are a 3X8 battalion with two four-gun platoons in three firing batteries, a 3X6 battalion with three six-gun batteries, a 4X6 battalion with four six-gun batteries, and a 3X4 battalion with three four-gun batteries. The AFAS White Paper states that no matter which of the four battalion organizations adopted by the Army, the employment of the field artillery battery will be the same at the battery level or below.

At the battery level, the AFAS White Paper recommended that the Advanced Field Artillery System be employed in pairs or as autonomous howitzers. The paper stated that this decision should be made based on elements of METT-T (specifically Mission, Enemy, and Training). Consolidation of the howitzers to a four-gun platoon/battery or a six-gun battery should be performed when an extremely high ground threat exists or when equipment failures with the platoon operations center or a number of Advance Filed

Artillery System howitzers exist (i.e., three or more howitzers' computers are inoperable[46]).

Command and control of platoon operations will require more from the platoon leadership than in previous platoon or batter-based operations. Two examples of the increased Advanced Field Artillery System capabilities and the effect on command and control are:

> The advanced capabilities of the AFAS/FARV allow a more decentralized execution than is feasible with current howitzer systems; this ability should be taken advantage of whenever possible. Employment and emplacement considerations should not be confused with how units are best to engage the enemy. Units could be under decentralized control for positioning but under very centralized control for engagement of the enemy based on the commander's intent, attack guidance and vision of how best to fight.[47]

and,

> Platoon leaders and sergeants will be faced with similar problems to those of the battery commander. They will not only have to know about technical and tactical fire control, they will also have to be familiar with logistical resupply procedures, maintenance, messing, medical and survey operations to name just a few areas of additional areas of interest. Coordination with adjacent units at platoon level will become the normal rather than the exception. Planning for and conducting rearm, refit, and refuel operations will become a full time job for the platoon leader. The platoon sergeant will assist in the planning but will have to ensure these operation are executed flawlessly.[48]

Platoon duties that will be more difficult to perform or are unique to an Advanced Field Artillery System platoon because of its decentralized control are: logistics to include food, fuel, ammunition, and liquid propellent resupply;

terrain management; platoon mutual supporting fires; platoon defense; casualty collection; communications systems control; and degraded operations plan/standing operations procedures.

The technical fire control of the Advanced Field Artillery System and its regard to massing also have an impact on this thesis. "The preferred method of engagement for the AFAS will be MRSI...."[49] The MRSI (multiple rounds simultaneous impact) capability in the Advanced Field Artillery System is the unique capability of one howitzer to place four to six rounds on a target simultaneously as, in effect, a one-gun time-on-target. This capability is due to the system's use of liquid propellent, rapid loading rates, and on-board technical fire control. Because of laws of physics, this capability exists at ranges between six and forty kilometers and will be available on the Advanced Field Artillery System between eight and thirty-six kilometers.[50] This capability allows for a platoon to achieve the same massing effects of two batteries up to a battalion. The AFAS White Paper suggests that when a battalion receives a fire mission, the battalion fire direction center should determine the number of rounds to be fired to produce the desired effects and then transmit the fire mission to the minimum number of platoons required based on the MRSI capability. This procedure will, in turn, allow for the exposure of fewer howitzers to enemy counterfire assets;

and, also allow the battalion to mass on multiple targets with the effects of multiple battalions if necessary.

Endnotes

[1]Boyd L. Dastrup, King of Battle: A Branch History of the U.S. Army's Field Artillery (Fort Monroe, VA: Office of the Command Historian, U.S. Army Training and Analysis Command, 1992), 310.

[2]U.S. Army, Artillery Support of the Restructured Heavy Division, 1981 (Fort Sill, OK: Department of the Army, 10 November 1976), 1.

[3]Terrain gun positioning is a method of positioning howitzers by dispersing them over a large area and maximizing the natural cover and concealment offered by the local terrain. Terrain gun positioning is used extensively when enemy counterfire or air attack threat is likely.

[4]Artillery Support of the Restructured Heavy Division, 1981, A-7.

[5]Ibid., A-7.

[6]Ibid., A-8.

[7]Ibid., B-8.

[8]Ibid., 5.

[9]John L. Romjue, The Army of Excellence: The Development of the 1980s Army (Fort Monroe, VA: U.S. Army Training and Doctrine Command, 1993), 24-26.

[10]Major General Raphael J. Hallada, "3X8: Our Force Multiplier," Field Artillery Journal (February 1989), 1.

[11]Ibid., 1.

[12]Ibid., 1.

[13]Ibid., 1.

[14]Colonel John M. Pickler and Major Mark P. Gay, "3X8 Matures for Pathfinder Power," Field Artillery Journal (February 1989): 24.

[15]Captain C. Craig Buzon, "Operations Implications of 3X8 Field Artillery Battalions" (Thesis, Naval Postgraduate School, 1990), 2.

[16]Ibid., 11.

[17]Ibid., 30.

[18]U.S. Army, Field Manual 6-50, Tactics, Techniques, and Procedures for the Cannon Firing Battery (Washington, D.C.: Department of the Army, August 1992), 1-1.

[19]Ibid., 1-1.

[20]Ibid., 9-11.

[21]Colonel James M. Gass, "1st Cav Div Arty: Report from Operation Desert Shield," Field Artillery Journal (February 1991): 26.

[22]Colonel David A. Rolston, "Victory Artillery in Operation Desert Shield," Field Artillery Journal (April 1991): 23.

[23]Ibid., 23.

[24]Ibid., 23.

[25]Lieutenant Colonel John A. Floris, "1-41 FA in Desert Storm: A Test Bed for Doctrine and Equipment," Field Artillery Journal (April 1992): 41.

[26]Ibid., 41.

[27]Lieutenant Colonel M. Thomas Davis, "Reflection on the Storm: FA Vector for the Future," Field Artillery Journal (August 1993): 46.

[28]Lieutenant Colonel L. Scott Lingamfelter, "In the Wake of the Storm: Improving the FA After Operation Desert Storm," Field Artillery Journal (August 1991): 27.

[29]Ibid., 27.

[30]Ibid., 28.

[31]Captain Matthew A. Finlon, "Analysis of the Field Artillery Battalion Organization Using a Markov Chain" (Thesis, Naval Postgraduate School, 1991), 12.

[32]Ibid., 7.

[33]Ibid., 32.

[34]Ibid., 31.

[35]Infiltration is a movement technique of moving by anything less than the entire firing battery or firing platoon. The method of moving by infiltration is listed in Field Manual 6-50 for both a platoon-based and battery-based organization. Field Manual 6-50 specifically states "When a platoon moves by infiltration, vehicles are dispatched individually or in small groups without reference to a march table." Captain Finlon is incorrect to allow only battery-based units to move in two-gun subsets when the option is just as applicable to platoon-based units.

[36]U.S. Army, ST 6-50-60 Tactics, Techniques, and Procedures for the M109A6 (Paladin) Howitzer Section, Platoon, Battery, and Battalion (Fort Sill, OK: United States Army Field Artillery School, June 1993), 1-2.

[37]Ibid., 1-3.

[38]Ibid., 1-8.

[39]Ibid., 3-38.

[40]Ibid., 3-4.

[41]Military Professional Resources, Inc., Transition Of Future Cannon Artillery Study - II (TOFCAS-II) (Alexandria, VA: Military Professional Resources, Inc., September 1993), 1.

[42]Ibid., 9.

[43]Ibid., 42.

[44]Ibid., 42.

[45]Ibid., 76.

[46]Tec-Masters, Inc., and Advanced Systems Technology, Inc., Advanced Field Artillery System and Future Armored Resupply Vehicle Firing Battery, Platoon, and Section White Paper: Tactics, Techniques, and Procedures (Alexandria, VA: Tec-Masters, Inc., July, 1993), 32.

[47]Ibid., 19.

[48]Ibid., 26.

[49]Ibid., 36.

[50]U.S. Army, Memorandum SUBJECT: Final Draft Operational Requirements Documents (ORD) for the Advanced Field Artillery System (AFAS), and Future Armored Resupply Vehicle (FARV) (Fort Sill, OK: Department of the Army, 14 June 1993), A-6.

CHAPTER THREE

RESEARCH METHODOLOGY

The research methodology in this thesis follows the five elements of critical thinking. These five elements are observing, questioning, investigating, analyzing, and synthesizing.[1]

Observing

For the author, the observing of different artillery organizations and the effectiveness of these organizations began in 1986 when the battalion I was assigned to converted from a 3X6 battery-based organization to a 3X8 platoon-based organization. As a battalion fire direction officer and battalion maintenance officer, I observed problems in the new platoon-based operations the battalion was conducting. Specifically, these problems were in the areas of command and control, officer and noncommissioned officer responsibilities, and fire direction.

Th next time I made significant observations about 3X8 operat ons was in 1990 while serving as a firing battery commander. During Operation Desert Shield, the battalion I was serving in, and later the entire 1st Cavalry Division

Artillery, converted its operations from platoon-based to an ad hoc battery-based operation. Reasons for this conversion are covered in Chapter Two. At that time, I considered this battery-based method a temporary solution for the short-term situation we faced. This solution also exposed me to the fact that the field artillery had no tactics, techniques, and procedures for the consolidation of two complete four-gun firing platoons. Problems I observed while in command included the management of battery leadership (i.e., two each of platoon leaders, platoon sergeants, gunnery sergeants, and fire direction officers/centers at the same firing point), fire direction center span of command and control over eight guns, and gunnery issues.

The last significant observation about artillery organizations I made was as a gunnery instructor at the U.S. Army Field Artillery School. In November 1992, I was assigned the task of streamlining artillery occupation procedures. This tasking was initiated by Major General Marty, then commander of the Field Artillery School and Center, based on the poor occupation times by field artillery units at the National Training Center. While working on this problem with observer controllers at the National Training Center, I discovered that almost none of the units were conducting platoon-based operations during their rotations. In fact, units were conducting variations of the "desert wedge" they used in the Persian Gulf (1st

Cavalry, 24th Infantry, and 1st Infantry Divisions). The two divisions (4th Infantry and 5th Infantry Divisions) that were not deployed to the Persian Gulf were also conducting battery-based operations based on experiments conducted at home station and numerous articles on the successes of the desert wedge.

Questioning

The significance of these observations is that a vast majority of units were using somewhat similar battery-based operations but techniques varied from division to division based on Operation Desert Storm experiences and perceived home station successes. Because Field Manual 6-50 Tactics, Techniques, and Procedures for The Field Artillery Cannon Battery does not specifically address procedures for this type of organization, units freely experimented with employment techniques, especially in the areas of battery command and control and fire direction center operations. The problem of creating better occupation procedures was frustrating when units were conducting non-standard operations and the organization being used is not currently recognized by the field artillery mission training plans (MTPs).

These three periods of observations led to my questioning of field artillery organizations and, specifically, the battery-based versus platoon-based

organizations. This thesis looks at the current field artillery organizations, both battery-based and platoon-based, and compares them to the capabilities and needs of the field artillery of the future. Specifically, which organization supports the field artillery's future capabilities in the areas of advanced weapon systems, gunnery techniques, and ammunition capabilities.

Investigating

Investigation will be conducted primarily by reviewing literature and studies conducted on artillery organizations. Also, I will conduct interviews with subject matter experts stationed at Fort Sill, the National Training Center, and Fort Leavenworth. Results of the investigation are contained in the review of the literature and analysis chapters. The evidence gathered through investigation will be categorized primarily by the seven subordinate thesis questions outlined in chapter one. These seven subordinate questions are designed to focus the gathering of evidence and analysis methods in a sequential nature.

Analyzing

Analysis of the evidence will be conducted in chapter four. The analysis will be a combination of analyzing tactics, techniques, and procedures; historical examples of unit organizations; and future artillery systems and requirements. This "common type" MMAS thesis[2] of

analyzing historical doctrinal procedures and developing suggested future doctrinal methods lends itself primarily to a qualitative approach in the analysis of the evidence. Some of the evidence gathered is quantitative in nature and will require quantitative analysis.

Based on the analysis of the gathered evidence, I will have to pass judgment (approval or disapproval) on occurrences by analyzing facts and inferences gathered. All evidence will be analyzed based on its relevance to the subordinate questions and the credibility of the source before judgment can be passed. The final product of the analysis will be answering the thesis' subordinate questions.

Synthesizing

Synthesis of the research question will consist of producing conclusions and recommendations for current and future artillery organizations. These conclusions and recommendations will be contained in chapter five.

Endnotes

[1]Dr. Bruce Menning, guest lecturer MMAS program, from a lecture conducted on 22 October 1993 titled "Scholarly Perspectives."

[2]Ibid.

CHAPTER FOUR

ANALYSIS

This chapter analyzes information relevant to the thesis question, subordinate thesis questions, and issues pertaining to 3X8 operations. This chapter is divided into seven sections corresponding to the seven subordinate thesis questions.

Why did the U.S. Army field artillery reorganize its direct support battalions to the 3X8 platoon-based operation?

The primary reason for the change in the artillery organization in the mid-1980's was the overall need for a more powerful division organization recognized by the Army's senior leaders in the early 1970's. The Army during this period was facing the bi-polar threat of the Soviet Union and its Warsaw Pact allies. To fight outnumbered and win, Army leadership recognized the need for a new doctrine and also a more combat effective division structure. The Division 86 and later the Army of Excellence programs were responsible for the restructuring of the Army's heavy divisions from Reorganization Objective, Army Divisions (ROADS) to their present day configurations. The

restructuring of the division artillery was a part of this overall effort.

Just as the Army was restructuring to combat the enormous Soviet/Warsaw Pact threat, the Field Artillery School was developing division and corps artillery groupings to combat the massive Soviet artillery threat. Along with having numerical superiority over U.S. artillery, the Soviets were also taking steps to make their artillery more technically proficient. Soviet counterbattery radars along with the already present sound-flash platoons were being incorporated into their target acquisition capabilities. Improvements in Soviet gunnery techniques, to include limited automation, were being made. Finally, more Soviet self-propelled artillery (models 2S1 and 2S3), designed much like the U.S. M109 series, were being fielded in their regimental and divisional artillery groupings.[1] It was against this threat that the U.S. Army Field Artillery School developed its current division artillery for a heavy division.

The Field Artillery School, through the Directorate of Combat Developments, conducted a number of legal mix studies designed at improving and developing artillery weapons, ammunition, and organizational design. The Legal Mix V study team recommended a battalion structure of four batteries with eight howitzers per battery as the optimum structure for the cannon artillery in the Army's heavy

division. The study further recommended the eight-gun battery be divided into two four-gun firing platoons with a fire direction center in each platoon controlling the platoon's fires. The overarching concern and drive for having separate firing platoons versus one firing battery was the need for survivability when facing the Soviet counterbattery, ground, and air threats. Other considerations for platoon operations included its lethality and mobility.

Two other significant considerations in the selection of 3X8 operations existed. One consideration was the desire to structure the field artillery company-grade officer positions closer to those of the Armor and Infantry branches in the area of platoon leaders.[2] Both armor and infantry companies have three platoon leader positions and one executive officer per company. These jobs are considered essential in a combat arms officer's career progression. The field artillery in a battery-based organization has only two lieutenant positions - battery executive officer and battery fire direction officer. With platoon-based operations, the number of lieutenants in a battery doubles with two platoon leaders and two fire direction officers. This brings the number of officers in a battery to an equal number when compared to an armor or infantry company and also a similar duty description in the form of platoon leader.

A second consideration was the battery computer system and its criteria for selecting howitzer aimpoints. The default aimpoint selection standard for the battery computer system is a circular sheaf with aimpoints positioned along a fifty meter circle around the target grid location. The aimpoints are spaced equidistant around the circle. No matter how many howitzers are in the firing unit, the circle does not increase in size, just the number of aimpoints increase (see figure 10). This in effect makes for diminishing returns with each additional howitzer after four aimpoints.[3]

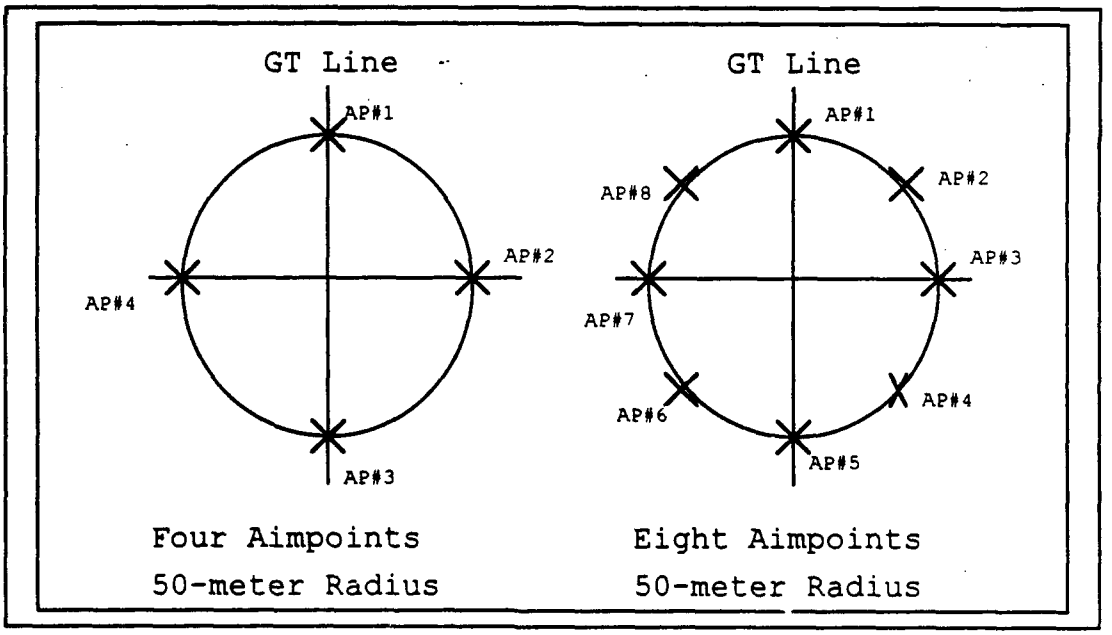

Figure 10: Battery Computer System Default Sheaf[4]

The final decision to go with three batteries versus four was in keeping with the size restraints for the division artillery and the constraints placed on the armored and mechanized infantry divisions themselves.[5] To aid in the employment of 3X8 platoon-based operations were three essential items of new equipment to be fielded during this time period. The Position/Azimuth Determining System (PADS) would be fielded with two systems per battalion to provide faster and more accurate survey to the firing units. The battery computer system (BCS) would be fielded one per platoon fire direction center and would enable platoons to digitally communicate with the battalion fire direction center and for increased survivability by allowing a platoon to occupy a large area and use terrain gun positioning techniques on a routine basis. The third item was the Advanced Field Artillery Tactical Data System (AFATDS). The Advanced Field Artillery Tactical Data System was designed to replace the aging Tactical Fire Direction System (TACFIRE) in the battalion fire direction center. This would give the battalion a responsive fire direction computer capable of performing tactical and technical fire direction and ease the increased command and control requirements that 3X8 platoon-based operations creates for the battalion. The TACFIRE system was identified as needing to be replaced as early as 1980 during the Fire Support Mission Area Analysis.[6] The Advanced Field Artillery

Tactical Data System is not currently fielded in the Army and is not scheduled to be fielded until the third quarter, fiscal year 1994 with the force package one units being completely fielded in fiscal year 1996.[7]

What are the U.S. artillery tactics for employing a 3X8 artillery battalion?

The current Field Manual 6-20-1 is the base manual for cannon battalion operations. This manual does not address any issues as far as a difference in duties or staff functions between 3X8 operations and 3X6 operations. The primary reason for this is that the differences between the two organizations should be transparent at battalion level for the various staff functions. Both organizations have three firing batteries to support and each battery has one battery headquarters as a central point to handle logistics, personnel, medical, maintenance, etc. The one staff function that is most affected by 3X8 operations is the battalion operations (S3) function. Field Manual 6-20-1 does not address any issues of difference between platoon-based and battery-based operations. In fact, Field Manual 6-20-1 does not include the platoon positioning techniques available to the battalion operations officer and mentioned in Field Manual 6-50.

The current Field Manual 6-50 does cover the differences in platoon and battery-based operations. For cannon batteries in the U.S. Army, battalions organized for

battery-based operation exist in the Army's light, airborne, and air assault divisions utilizing towed howitzers. Cannon batteries structured for platoon-based operations exist in the Army's armored and mechanized infantry divisions utilizing self-propelled howitzers. It is interesting to note that Field Manual 6-50 reinforces this concept by showing all battery-based operations using towed weapons and platoon-based operations using self-propelled weapons.

Field Manual 6-50 also does not mention conditions that call for the consolidation of a platoon-based battery into one firing unit. The manual has one example of a consolidated firing battery of eight guns with one fire direction center. Although this is a form of degraded mode operations,[8] Field Manual 6-50 does not specifically address it as such. Field Manual 6-50 does not address degraded mode operations and the parameters in which a unit might be required to enter these operations. Furthermore, the artillery's Mission Training Plans (MTPs) list occupation time standards for four-gun firing platoons, four-gun firing batteries, and six-gun batteries but the manuals (one manual published for each type of howitzer battalion/battery) do not recognize or establish an occupation standard for an eight-gun firing battery.

In conclusion, the tactics, techniques and procedures for the U.S. Army cannon units have been and currently are designed to support platoon operations in the

Army's heavy divisions and battery operations in the Army's light divisions. Tactics, techniques, and procedures do not exist to support consolidated operations in a platoon-based organization. The primary cannon manuals, FM 6-20-1 and FM 6-50 also fail to cover degraded mode operations.

How were 3X8 artillery battalions conducting operations prior to Operations Desert Shield and Desert Storm?

This question covers the period from 1985 when the first 3X8 battalion was fielded until August 1990 when Operation Desert Shield started. Research shows that during this period units were conducting 3X8 platoon-based operations as specified in Training Circular 6-50 (later Field Manual 6-50). Evidence from the National Training Center archives,[9] National Training Center after-action reports, and professional articles indicate that artillery units were using platoon-based operations and would switch to battery-based operations only if equipment losses would cause this action to be necessary. Examples of equipment losses that would cause a battery to consolidate is the loss of one of the two available platoon fire direction centers or the loss of two howitzer sections within one platoon.

3X8 operations were not without their share of criticism. During this time period, the most popular case against 3X8 operations is the 4X6 organization or "additional battery" argument. The 4X6 organization argument appears in a number of professional journal

articles, theses, and crosstalk amongst artillerymen. The general basis behind the case for 4X6 operations is that the additional six howitzers should have been placed into the artillery battalions as a fourth firing battery. This action would give the battalion fewer firing units to command and control than platoon-based operations while keeping the fa .ar battery operations the same as they were before 3X8 operations.

While there was dissatisfaction with some parts of 3X8 operations (some examples are cited in Chapter Two), it appears that most units were conducting 3X8 platoon-based operations both at home station, Europe, and the National Training Center and reporting either no significant problems or success with the relatively new organization. A strong supporter of platoon-based operations was Major General Hallada who was Commandant of the Field Artillery School from August 1987 to July 1991. General Hallada mentions 3X8 operations as an organizational step towards the decentralized operations that the M109A6 Paladin and Advanced Field Artillery System would demand.[10] Although there is no evidence on what indirect or direct influence General Hallada had on 3X8 operations; by virtue of being the Commandant, he was actively engaged in the pre-command course for battalion and division artillery commanders, annual fire support conferences, and privy to all National Training Center after-action reports.

How were 3X8 artillery battalions employed during Operation Desert Storm?

When compared to how U.S. field artillery battalions were conducting operations at the National Training Center prior to Operations Desert Shield and Desert Storm, there was a significant change in tactics being employed by direct support field artillery battalions during Operations Desert Shield and Desert Storm. Prior to Operations Desert Shield/Desert Storm, field artillery battalions were training using 3X8 platoon-based operations both at the National Training Center and at the unit's home stations. This method of employment, as documented in National Training Center after-action reports, shows most units following maneuver forces on offensive operations using platoon advanced parties[11] and leapfrogging units either single platoons or batteries moving in separate platoon formations to ensure continuous fire support was available to the maneuver commander when called upon. Major problems seen with this employment technique both in the after-action reports, professional journals, and theses, are the inability of the artillery to keep up with maneuver while conducting a series of subsequent occupations and the inability to mass the battalion in a timely manner with so many units continuously on the move. There were also problems with the ability of the battalion operations center and Tacfire computer system to command and control six firing platoons effectively.

The change in employment techniques during Operations Desert Shield and Desert Storm appears to be a classic example of METT-T (mission, enemy, terrain, troops available, and time) analysis overriding the established tactics, techniques, and procedures. Specifically, the mission, enemy, and terrain parts of METT-T seemed to have had the most influence on the tactical employment decisions based on professional articles submitted before and after Operation Desert Storm. It is important to note that the initial two deployed heavy division artilleries, 24th Infantry Division and 1st Cavalry Division Artilleries, appear to have led the way in both development of a 3X8 battery-based employment techniques and the influencing of other division artilleries that arrived subsequently into theater. Both the 24th Infantry Divarty and the 1st Cavalry Divarty wrote a total of three Field Artillery Journal articles[12] prior to Operation Desert Storm and cross-talk between XVIII Airborne Corps Artillery and the later arriving VII Corps Artillery was taking place on a myriad of subjects to include best employment techniques. The end result was of the five division artilleries deployed in support of their divisions, all five adopted a form of battery-based operations even though actual employment techniques varied from division artillery to division artillery.

The METT-T influence on the artillery employment techniques is significant when compared to the METT-T faced by units at the National Training Center. The mission during Operation Desert Storm was offensive in nature in order to eject the Iraqi army from the Kuwaiti theater of operations. Missions received at the National Training Center are both offensive and defensive in nature and are tied directly to a unit's Mission Essential Task List (METL). Both the XVIII Airborne Corps and VII Corps initially sought to avoid the Iraqi built-up defensive belts and attack the enemy's armored and mechanized forces. In doing this, divisions were expected to move great distances and attack enemy forces that would also probably be moving. This would demand divisions to conduct movement-to-contact formations. Although somewhat similar in terrain characteristics, the distances involved at the National Training Center do not come close to comparing with those distances encountered by units during Operation Desert Storm. These long movement-to-contact distances ruled out the use of advanced parties and leapfrogging platoons or batteries from position to position. If advanced parties were not to be used, then the battery commander was now available to travel with his battery. This, as cited in various professional journal articles, placed the unit's senior leader with all his experience, additional

communication assets, navigational devices, and survey back in the firing unit.

The other major condition that varies significantly between the National Training Center and Operation Desert Storm is that of the threat. The enemy at the National Training Center is the "world-class OPFOR" (opposing forces). This world-class OPFOR is comprised of U.S. Army soldiers trained and utilizing Soviet mechanized tactics with the substantial advantage of conducting 12-14 training rotations a year on familiar terrain. The OPFOR bring to the "battleground" a superb ground combat force to include a competent artillery group and a threat air force capable of attaining periodic air superiority and conducting close air support and air interdiction missions. To the field artillery these capabilities mean only one thing--disperse. Dispersion is accomplished by conducting platoon-based operations and by dispersing the howitzer sections within the platoon firing position itself. The perception of the Iraqi threat was much different than that of the National Training Center's OPFOR. Articles written both before and after Operation Desert Storm stressed that the major threats to U.S. artillery forces were perceived to be from bypassed enemy forces, enemy mines, and unexploded ordnance. It was assumed that the superior U.S. and coalition air forces would dominate; and also, that the Iraqi artillery, although impressive in its number of tubes, was not nearly as

proficient in the area of counterfire as U.S. forces. This threat analysis was conducive to conducting more centralized artillery operations utilizing battery-based employment techniques.

How are 3X8 battalions currently being employed at the National Training Center?

All evidence indicates that units brought the battery-based employment technique used during Operation Desert Storm, or a similar version, with them to the National Training Center. This use of battery-based employment occurred even though the mission, enemy, and terrain distances differ significantly between the National Training Center and Operation Desert Storm. A deputy senior field artillery observer/controller who had been stationed at the National Training Center for over two years since Operation Desert Storm said that he could count the number of times units conducted platoon-based operations on one hand.[13] In fact, it has become a significant event at the National Training Center if a unit does conduct platoon-based operations because of the need for additional observer/controllers to monitor platoon operations.

National Training Center observer/controllers report that 3X8 battery-based operations do work for most units for similar reasons cited by units during Operation Desert Storm. The primary drawbacks seen at the National Training Center fall into two categories--standardization between

field artillery units and leadership. Standardization problems exist with battery-based operations in that there are many "types" of employment techniques being used. Field Manual 6-50 describes battery-based employment methods only as they pertain to 3X6 field artillery battalions found mainly in the Army's light divisions. A six-gun firing battery is different when compared to an eight-gun firing battery not only in the two fewer howitzers but also only one fire direction center when compared to two, one battery executive officer compared to two platoon leaders, and one fire direction officer, one platoon sergeant, and one platoon gunnery sergeant when compared to two of each of these positions within the eight-gun firing battery. Because Field Manual 6-50 does not specifically address eight-gun battery operations as far as formations, duties and responsibilities, and fire direction center operations; units must take upon themselves the task of how to conduct battery-based operations. This is similar to the artillery's experiences in Operation Desert Storm where units were all conducting battery-based operations but actual techniques varied from unit to unit. Because of this shortage of doctrine, National Training Center observer/ controllers observe many different techniques of employing 3X8 battery-based operations and can only comment on what seems to work best based on their observed experiences (i.e., there is no wrong answer). An example of a doctrinal

shortage would be the use of the two fire direction centers. National Training Center observer/controllers recommend using one fire direction center as a "hot" fire direction center in that it commands and controls the eight howitzers while using the other fire direction center as the battery operations center to monitor the current situation, conduct battery operational issues such as submitting and receiving administrative and logistical reports, and be prepared to accept control of the howitzers. Although this is a "recommended" technique, the observer/ controllers see units also conducting operations with both fire direction centers controlling their own assigned four howitzers throughout the rotation. Even with units using a hot fire direction center and battery operations center, there exist various techniques within each fire direction center on how to best perform their mission - again because no doctrinal manual, specifically Field Manual 6-50, spells out the recommended procedures. The use of the two fire direction centers is just one standardization issue. Other differences mentioned by the observer/controllers included movement techniques, occupation techniques, and senior battery leader duties and responsibilities.[14]

It is in the area of senior battery leadership and command and control where battery-based operations faces its most troubling issues. A six-gun firing battery is organized with a battery executive officer in charge and

supported by a platoon sergeant and gunnery sergeant (both sergeants first class) to command and control the firing battery. Also, within the 3X6 battery organization is a battery fire direction center with a battery fire direction officer and chief computer (staff sergeant). In an eight-gun firing battery conducting battery-based operations there exists two each of the aforementioned positions and organizations. The three major problems with this setup exist in the areas of command and control, duties and responsibilities, and utilization of position equivalent to the rank assigned.

In a battery-based system, the executive officer routinely directs the action of the firing battery. The battery commander's routine duties; amongst them the conduct of reconnaissance, selection, and occupation of a position duties, command and control issues with battalion, logistical and maintenance issues, often keep him away from the firing battery for extended periods of time. For a platoon-based operations, the platoon leaders are in charge of their respective platoons for the same reasons mentioned for battery-based operations. When a 3X8 battery is conducting battery-based operations, the battery commander must designate one of the two platoon leaders as in charge to ensure unity of effort and command.

Because of the extra number of senior battery leadership positions in a battery-based 3X8 organization,

the duties and responsibilities of personnel overlap and some positions will do less while others will have to do more. An example of this is in laying the battery upon occupation which is a task performed by the gunnery sergeant.[15] With consolidated battery operations there are two platoon sergeants present but only one unit required to be laid. What if anything does the other gunnery sergeant do? The answer has not been addressed by the Field Artillery School. The same can be said for safetying the battery which has historically been a platoon leader duty.[16] Carrying this same concept out to hot and cold fire direction centers similar problems exist. Now under battery-based operations in a 3X8 battalion the hot platoon fire direction center has twice as many howitzers to command and control during firing. The cold fire direction center is now performing the duties of a battery operations center which has historically been manned by the nuclear, biological, and chemical noncommissioned officer, the communications noncommissioned officer, and a fire support specialist.[17]

These last points lead into the third shortfall which is utilization of positions equivalent to the assigned rank. National Training Center observer/controllers cite that due to the excessive amounts of leadership during consolidated operations, lack of clearly defined duties and responsibilities, and overlap of duties and responsibilities

that some key leaders are under-utilized during rotations and in some cases bored. Because some of the jobs now overlap, some units rotate positions every other mission while other units just maintain set duties and allow their leadership to specialize in their reduced assigned areas. What occurs in either case is key leaders not getting the benefit of the full training cycle or becoming specialized in a few facets of their overall duty description. In either case, the platoon leader, fire direction officer, platoon sergeant, or gunnery sergeant suffer in the areas of training and professional development.

Another important issue involved with 3X8 platoon versus battery-based operations deals with organizational flexibility. Prior to Operation Desert Storm, units training at the National Training Center were conducting platoon-based operations but could, and often did, conduct battery-based operations when the effects of attrition due to combat warranted the change. This degree of flexibility is not seen after Operation Desert Storm at the National Training Center. Units conducting battery-based operations are staying battery-based throughout the training rotation regardless of changes in mission, enemy, or attrition due to combat. It is important to note that losses within a battery encourage battery-based operations and discourage platoon-based operations.

How does the current field artillery employment techniques at the National Training Center compare with the initial intent of 3X8 artillery operations?

The primary intent of 3X8 operations was to increase the firepower within the division artillery in the Army's heavy divisions. By using platoon-based firing units, the direct support field artillery battalion would be more flexible, responsive, mobile, survivable, and able to mass artillery on multiple targets when compared with the previous 3X6 battery-based organization.

When comparing platoon-based versus battery-based operations at the National Training Center, a few points must be made. First, any comparison of the two organizations is purely subjective in nature. One can not objectively compare a platoon-based unit performances prior to Operation Desert Storm with the more prevalent battery-based operations after Operation Desert Storm. Mainly, because of the differences in unit training and personnel position comparisons, but also because differences in the way the National Training Center conducts its training rotations over this period of time. No study has been conducted since Operation Desert Storm to compare the two employment techniques. For a study to be objective the same unit would have to perform its mission using both employment techniques against an enemy scenario that is kept standard. Human preferences between the two employment techniques would also require monitoring and filtering.

Based on doctrinal manuals and past literature, 3X8 operations were planned to be platoon-based operations. All emphasis in Field Manual 6-50 is on platoon-based operations for self-propelled units. When comparing the two organizations, shortfalls in battery-based operations occur in the areas of flexibility, survivability, and massing of fires against multiple targets. Mobility and responsiveness between the two employment techniques are seen to be virtually equal.[18]

Flexibility in platoon-based operations occurs because of the increased number of firing units on the battlefield for the battalion operations officer to use in tailoring the field artillery fight to the maneuver commander's needs and intent. Battery-based operations reduce the number of firing units and the amount of flexibility allowed to the battalion. A residual effect of platoon-based operations is the flexibility to conduct battery operations when necessary. This degree of flexibility for battery-based operations to change to platoon-based operations exists but, in practice at the National Training Center, is not observed.

Survivability for the artillery is a relative term and relates directly to the enemy's threat to the artillery. When 3X8 platoon-based operations were developed, survivability using platoons was the optimum choice when considering the Soviet counterfire, rotary wing aviation,

and air force threats. When compared to this threat, which still exists today in many scenarios, battery-based operations places the artillery as a whole at a greater risk by providing fewer and more lucrative targets for the enemy to attack. The increased size of the artillery firing unit in this threat scenario increases the risk of a larger proportion of the artillery force being destroyed in a single attack. Because the threat to the artillery is relative to the enemy's capabilities and disposition, there are examples where battery-based operations would be more survivable. Some examples include when guerilla or ground based threats are prevalent or when large amounts of bypassed enemy forces will exist which facilitates battery-based operations to enhance unit protection. Another scenario in which a battery might consolidate is if the enemy counterbattery and air threat is weak reducing the threat of unit detection and engagement.

The ability to mass artillery on multiple targets as envisioned in General Hallada's article is based on six firing units allowing a field artillery battalion to engage more targets than three firing units could. This point of contention is easy to see as true. The concept of mass is also very dependent on both target description and ammunition to be used. The more sophisticated artillery ammunition physically requires less massing and the initial benefits of massing are less than with the older

conventional high explosive munitions. Copperhead, dual-purpose improved conventional munitions (DPICM), and Search and Destroy Armor Munitions (SADARM) are present in the Army's wartime unit basic loads and differ significantly with conventional high explosive ammunition. The advancements in the areas of ammunition technology has been to increase the probability of kills per round which then reduces the number of rounds required to defeat a target and the number of units required to mass on the target.[19]

With conventional high explosive ammunition, the element of mass is critical in that the target improves its disposition after the first volley and this action makes subsequent volleys less effective. The more rounds fired in the first volley the greater the effects on a target.[20] For conventional high explosive ammunition, the projectile bursts either on the ground or at heights of burst of seven or twenty meters.[21] The shock and surprise effects are immediate for high explosive projectiles. For the more advanced munitions like DPICM and SADARM, the projectile delivers its payload a considerable distance above the target area reducing the element of surprise (the optimum height of burst for DPICM is 270 meters above the target). The element of mass for these advanced munitions is achieved to a great extent by the number of submunitions per artillery projectile (DPICM has 88 grenades in each 155mm round)[22] or the deployed payload actively seeking the target

in the case of the SADARM submunitions. The Copperhead projectile requires an observer to designate the target area with a laser pulse repetition frequency code for the projectile to acquire and glide on to the target.[23] An observer must attack multiple targets at thirty second intervals[24] so the element of mass does not apply to the howitzers but more correctly to the number of observers in the target area. The advancements of field artillery munitions allow for multiple firing units to engage multiple targets and a decrease in the need for battalion and division artillery massed missions. Platoon-based operations has the advantage over battery-based operations in the ability to exploit the capability of engaging multiple targets with multiple firing units.

How does current training at battery-based operations affect the field artillery of the future?

In general, current reliance on battery-based operations will have a negative affect on field artillery operations in the future. The two primary field artillery systems that are planned to be in the Army's heavy divisions are the M109A6 Paladin and the Advanced Field Artillery System (AFAS). Both of these systems unique and advanced capabilities are discussed in Section Five of Chapter Two. The advanced capabilities of these two systems are going to require decentralized operations at the battery level to optimize each systems ability to provide fire support. Both

the Paladin and the Advanced Field Artillery Systems tactics, techniques, and procedures for employment as outlined in their respective manuals call for platoon-based operations with four-gun platoons further divided into two-gun teams as the optimum employment technique. A platoon of the Advanced Field Artillery System howitzers will be able to further subdivide into single-gun autonomous operations.

The transition from 3X8 platoon-based operations to 3X8 battery-based operations which occurred during Operation Desert Storm and continues today marks a step away from the decentralized operations platoon-based operations brought the field artillery in the mid-80s. The effects of this step towards the more centralized 3X8 battery-based operations cannot be measured in terms of monies, equipment, or time lost. The effects will be seen at the junior and senior leader level in the future field artillery batteries in the future battalion operations officer and battalion commander positions.

Because battery-based operations centralize the decision-making cycle with the battery commander and sometimes the senior platoon leader selected to be the "battery executive officer", many of the junior leaders in battery-based operations are not prepared through training for the decisions they will need to make in Paladin or Advanced Field Artillery System equipped units. The centralization of decision making in battery-based

operations is not preparing officer and enlisted leaders for the significant change in decisionmaking the decentralized Paladin and Advanced Field Artillery System batteries will demand. Positions most significantly damaged in battery-based operations are the platoon leaders, fire direction officers, platoon sergeants, and platoon gunnery sergeants for reasons previously cited. Other examples of skills that are being diminished by 3X8 operations are:

1. Terrain management by the battalion operations officer is reduced. It is practically non-existent for the battery commander and platoon leaders are now non-players. Terrain management will become a critical skill for all three types of jobs under the new artillery systems.

2. Land navigation falls primarily under the battery commander and sometimes with the senior platoon leader as opposed to the battery commander, platoon leaders, and gunnery sergeants in the platoon-based organization. The advanced field artillery systems will place an emphasis on land navigation skills for battery commanders, platoon leaders, platoon sergeants, gunnery sergeants, and in some cases section chiefs.

3. Logistics is more centralized in battery operations with the battery commander and first sergeant assuming a majority of the duties and less platoon leader and platoon sergeant interaction than what is required in platoon-based operations. Again, due to its decentralized

operations, the advanced artillery systems will place more responsibilities on the junior battery leaders.

Endnotes

[1]Chris Bellamy, Red God of War: Soviet Artillery and Rocket Forces (London: Brassey Defence Publishers, 1986), 162-3, 142-6, 209-10.

[2]Information provided in an interview with Colonel Allen Resnik on 24 September 1993. Colonel Resnik served on the Legal Mix V study team and is currently in TRADOC Analysis Command, Fort Leavenworth.

[3]U.S. Army, TC 6-40A, Field Artillery Automated Cannon Gunnery (Washington: Department of the Army, November 1989), 10-8 to 10-11.

[4]Ibid., 10-8 to 10-11.

[5]Boyd L. Dastrup, King of Battle: A Branch History of the U.S. Army's Field Artillery, Fort Monroe, VA: Office of the Command Historian, U.S. Army TRADOC, 1992: 298.

[6]Ibid., 310.

[7]U.S. Army Field Artillery Center and School, Program and Project Summary Sheets, Fort Sill, OK: Directorate of Combat Developments, 1993: 39.

[8]Degraded mode operations is an artillery term used primarily when a battalion's or battery/platoon's automated method of determining fire direction becomes inoperable. An example would be if the battalion's Tacfire computer system became inoperable, then the battalion FDC would have to perform manual computations and transmit voice fire orders to the firing platoons. For purposes of this thesis, degraded mode operations refers to a battery that must consolidate because one of its two platoon Battery Computer Systems has become inoperable; or, if a platoon has lost two or more of its four howitzers for any reason. Degraded mode operations are not similar to purely battery-based operations where the decision to consolidate platoons is not due to attrition or maintenance failures of any equipment.

[9]Research of the National Training Center archives on platoon-based and battery-based operations conducted by Dr. Rodler Morris, Combined Arms Command Historian in October 1993.

[10]Major General Raphael J. Hallada, "3X8: Our Force Multiplier," Field Artillery Journal (February 1989): 1.

[11]For the field artillery, advanced parties conduct reconnaissance and selection of future positions for the platoon or battery main body. In platoon-based operations, advanced parties are led by the battery commander, gunnery sergeants from both platoons, and representatives from each of the platoon howitzer sections, fire direction center sections, and communications sections. Advanced parties are designed to facilitate the platoons' occupations of subsequent firing positions.

[12]Three professional articles were submitted to the Field Artillery Journal prior to Operation Desert Storm. Two of these articles were from the 1st Cavalry Division and one from the 24th Infantry Division. All three articles heavily emphasized the conduct of battery-based operations during Operation Desert Shield. All three articles are cited in the bibliography.

[13]Information provided in an interview on 10 September 1993 with Lieutenant Colonel L. Moore who served a deputy senior observer/controller for the field artillery at the National Training Center for over two years immediately following Operation Desert Storm

[14]Information provided in separate interviews with Lieutenant Colonel L. Moore and Captain J.T. Smith (14 October 1993). Captain Smith served as a firing battery observer/controller at the National Training Center subsequent to Operation Desert Storm.

[15]The act of laying the battery/platoon is the task of orienting the platoon's howitzers on a common direction immediately after arrival in a firing position. The parallel laying of the howitzers on a common azimuth allows for a common directional reference known as a deflection and for the massing of the platoon's howitzers on a target. The laying of the platoon is usually performed by the platoon gunnery sergeant but can also be performed by the platoon leader, platoon sergeant, or battery commander.

[16]The act of safetying the battery/platoon is the task of verifying the parallel lay of the howitzers to a certain tolerance (usually ±3 mils). This function is usually performed by the platoon leader but can also be performed by the platoon gunnery sergeant, platoon sergeant, or battery commander. For safety purposes, the same individual may not lay the platoon and safe the platoon.

[17]The battery operations center (BOC) is an operations center that is not currently manned or equipped by the Table of Organization. The personnel mentioned as typical for BOC operations are based on the author's experience both in the field and having to instruct battery operations at the Field Artillery School.

[18]This is due to the fact that both platoon and battery-based operations in 3X8 battalions utilize a battery headquarters for the units administrative vehicles making the firing units equal in mobility. Responsiveness was judged as equal based on the similar communications and data processing equipment both organizations possess.

[19]TC 6-40, C-7.

[20]Ibid., C-8.

[21]U.S. Army, TM 43-0001-28, Army Ammunition Data Sheets For Artillery Ammunition: Guns, Howitzers, Mortars, Recoilless Rifles, Grenade Launchers, and Artillery Fuzes (Washington, DC: Department of the Army, 30 August 1991), 3-74.

[22]Ibid., 3-105.

[23]TC 6-40, 11-17 to 11-18.

[24]Ibid., 11-21.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

This final thesis chapter is organized into two major parts. The conclusion portion of this chapter answers the thesis question as supported by the analysis of the seven subordinate questions. The recommendation portion of this chapter contains five recommendations designed at improving the field artillery's ability to conduct 3X8 operations currently and in the future. Each of the proposed recommendations contains four parts. These parts are: the recommendation, supporting background, advantages, and disadvantages.

Conclusion

How does the current trend of employing direct support field artillery battalions at the National Training Center affect U.S. field artillery tactics currently and in the future? Based on the analysis of the seven subordinate questions, the effects of direct support field artillery battalions using primarily battery-based organizations at the National Training Center are generally negative for U.S. artillery tactics presently and in the future. In

conducting battery-based operations in preparation for and during training at the National Training Center, units are reinforcing bad habits, minimizing leader responsibility and training, and not preparing future enlisted and officer leaders for the decentralized field artillery organizations of the future.

Bad habits are reinforced by units not organizing the field artillery battalion according to the METT-T that mission analysis indicates they are facing. The standard scenario at the National Training Center has a competent enemy force with counterfire, ground, and air threats to the artillery. Survivability, in the face of these type threats, demands the dispersion offered by platoon-based operations. The battery computer system firing solutions and advanced artillery munitions are also better suited to support platoon-based operations and multiple "massed" missions.

3X8 operations were designed with a command and control structure that supports platoon-based operations. Once consolidated in whole, this battery command and control structure exceeds what is necessary for an eight-gun unit. The overall effect of this consolidation of leadership is redundancy, overlap of jobs, and specialization in certain leadership positions. During training this overlap and specialization has an adverse effect on leader development

which, in turn, affects both the present and future artillery officer and enlisted leadership.

Two caveats must be made when stating that 3X8 battery-based operations have a negative effect on artillery tactics. First, 3X8 battery-based operations were very successful during Operation Desert Storm and appropriate for the METT-T and other challenges that units faced such as the limited number of maps.[1] Although successful, 3X8 battery-based operations were only used in combat for a two-week period prior to ground-day and for the five days of the ground war itself. Due to the overall success of the operation and the short period of its use, it is hard to fully evaluate the merits of battery-based operations and any shortfalls it might have encountered over time. Second, there exists a definite need for battery-based operations based on attrition of the battery due to combat or maintenance failures. The loss of two howitzers in a single platoon, one of the fire direction centers, or a platoon's key leaders warrants degraded mode operations and 3X8 artillery units must maintain this capability.

Recommendations

First Recommendation

Recommendation: That the Field Artillery School incorporate 3X8 degraded-mode operations in FM 6-50 to include parameters for initiating degraded mode operations,

duties and responsibilities of battery personnel, and fire direction center operations for operations when both fire direction centers are operational.

Background: FM 6-50 presently does not have any tactics, techniques, and procedures covering degraded mode operations. Degraded mode operations are a necessity for a battery which loses one of its fire direction centers or enough howitzers to warrant abandoning platoon operations.

Advantages: Coverage of these operations would fill an information gap that currently exists in our battery tactics. Information provided by FM 6-50 on degraded mode operations would facilitate standardization between units and ease the transition between platoon to battery operations during a period of time where a unit already is facing a stressful situation, i.e. combat losses.

Disadvantages: None.

Second Recommendation

Recommendation: That the Field Artillery School incorporate 3X8 battery-based operations in FM 6-50 to include parameters for initiating battery-based operations, duties and responsibilities of battery personnel, and fire direction operations with two fire direction centers.

Background: FM 6-50 presently does not have any tactics, techniques, and procedures covering battery-based operations. The manual also does not cover what situations warrant the consolidation of a 3X8 battery in its entirety.

Advantages: Coverage of these operations would fill an information gap that currently exists in our battery tactics. Information provided by FM 6-50 on battery-based operations would facilitate standardization between units within the U.S. Army. FM 6-50 could also outline duties and responsibilities for key leaders in a consolidated battery designed to reduce the problems of duty overlap and command and control.

Disadvantages: None.

Third Recommendation

Recommendation: That the National Training Center, at a minimum, make units demonstrate the ability to conduct platoon-based operations during a portion of the training rotation. Accomplish this task by either announcing the requirement outright before a unit arrives for their training rotation; or, portray a scenario that obviously calls for dispersion of artillery and threatens to punish large accumulations of artillery with significant combat losses.

Background: The National Training Center takes a very "hands off" approach to unit tactical decisions during the training rotation. Observer/controllers are in the unit to observe, control the events at the National Training Center, and provide feedback to the units on their performance in an after-action review environment. Observer/Controllers do not directly control or try to

influence unit tactical decisions. Units have not been considering the OPFOR's considerable threat to the artillery in the form of counterfire, rotary aviation, or threat air assets when organizing their artillery batteries in a battery-based organization.

Advantages: This recommended action would cause a unit to demonstrate its flexibility in the area of platoon-based operations. It would force units that desire to conduct battery-based operation to train at home station in platoon-based operations. This action would also reacquaint platoon leaders, platoon sergeants, platoon fire direction officers, and gunnery sergeants with the full spectrum of their duties and responsibilities.

Disadvantages: The performance of this recommended action would create the perception of the National Training Center dictating unit organization.

Fourth Recommendation

Recommendation: Increase the number of Position/Azimuth Determining Systems (PADS) in a battalion from the present two to three systems.

Background: A common complaint and advantage cited in battery-based operations over platoon-based operations is the reduced need for survey that a battery-based field artillery battalion requires.[2] The need for survey exists because to achieve accurate predicted fires every firing unit requires to be surveyed on a common grid. Six firing

units is twice the requirement for survey over the three firing units required in battery-based operations. Currently, field artillery battalions have two Position/Azimuth Determining Systems in their survey sections. At the National Training Center, lack of survey is one commonly cited reason for units taking an excessive amount of time to occupy a position.

Advantages: The addition of a third Position/Azimuth Determining System would represent a 50% increase in systems available. Each of the three survey teams could be placed in direct support of a specific firing battery and controlled by the battery commander who would prioritize survey missions for his two firing platoons. This would reduce the survey planning required of the battalion operations officer. The battalion operations officer could manage the conventional survey team and task specific batteries for missions that exceeded the conventional survey team's abilities. The largest advantage would be the elimination of one of the reasons cited for battery-based operations.

Disadvantages: The actual Position/Azimuth Determining System would require a vehicle (HMMWV) and two additional survey personnel to man the system.

Fifth Recommendation

Recommendation: That the Field Artillery School field the Advanced Field Artillery Tactical Data System

(AFATDS) in reverse order to M109A2/3/5 units then M109A6 units.

Background: The Advanced Field Artillery Tactical Data System was envisioned to come on line during the same period of time that 3X8 operations were coming to fruition. Delays in budgeting and development have caused the fielding of this system to fall way behind its initial time schedule. The most common shortfall of platoon-based operations is that they have been deemed hard to command and control for the battalion operations section. One device responsible for the command and control of the battalion is the antiquated Tacfire computer system. The Tacfire computer system has been identified for over fourteen years as needing to be replaced.

Advantages: This action would get a modern command and control system for both fire direction and communications to the units that require it most. This action would help to eliminate the command and control excuse for not conducting platoon-based operations.

Disadvantages: This action would delay the full modernization of the M109A6 Paladin battalions.

In summary, the current fielding of the M109A6 Paladin and future fielding of the Advanced Field Artillery System represent exciting and dynamic times for the U.S. Army's field artillery. The foundation for using these new systems was built with the inception of platoon-based

operation in 1976. Artillerymen will soon command very decentralized battery organizations on our future battlefields and training for this situation today will make us a more effective organization in the future. Platoon-based operations should be our common method of employing 3X8 battalions while keeping in mind the doctrine along with tactics represent guidance that should be used with experience and common sense.

Endnotes

[1]Lieutenant Colonel Kenneth R. Knight. "Movement-to-Contact: 'Red Dragons' in Operation Desert Shield," Field Artillery Journal (June, 1991): 43; Colonel James M. Gass, "1st Cav Div Arty: Reports from Operation Desert Shield," Field Artillery Journal (February 1991): 26; Lieutenant Colonel John P. Floris, "1-41 FA in Desert Storm: A Test Bed for Doctrine and Equipment," Field Artillery Journal (December 1991): 41.

[2]Lieutenant Colonel M. Thomas Davis, "Reflections on the Storm: FA Vector for the Future," Field Artillery Journal (August 1993): 49.

BIBLIOGRAPHY

Books

Bellamy, Chris. Red God of War: Soviet Artillery and Rocket Forces. London: Brassey Defence Publishers, 1986.

Dastrup, Boyd L. King of Battle. A Branch History of the U.S. Army's Field Artillery. Fort Monroe, VA: TRADOC Branch History Series, 1992.

Dastrup, Boyd L. and Larry M. Kaplan. U.S. Army Field Artillery Center and Fort Sill Annual Command History, 1 January 1992 through 31 December 1992. Fort Sill, Oklahoma: Command Historian's Office, June 1993.

Leedy, Paul D. Practical Research Planning and Design. New York: Macmillian Publishing Company, 1985.

Romjue, John L. The Army of Excellence: The Development of the 1980s Army. Fort Monroe, VA: U.S. Army TRADOC, 1993.

Government Publications

U.S. Army. Artillery Support for the Restructured Heavy Division, 1981, Draft Study. Fort Sill, OK: U.S. Army Field Artillery Center, 10 November 1976.

U.S. Army. Field Artillery Organization and System Requirements, 1981-1986 (Legal Mix V). Volume III. 1986 Time Frame. Fort Sill, OK: U.S. Army Field Artillery Center, 29 December 1977.

U.S. Army. Field Artillery Organizational and System Requirements Study (1986-1995). Legal Mix VI. Fort Sill, OK: U.S. Army Field Artillery Center, January 1985.

U.S. Army. Field Manual 6-20, Fire Support in the AirLand Battle. Washington, D.C.: Department of the Army, 17 May 1988.

U.S. Army. Field Manual 6-20-1, Tactics, Techniques, and Procedures for The Field Artillery Cannon Battalion. Washington, D.C.: Department of the Army, 29 November 1990.

U.S. Army. Field Manual 6-50, Tactics, Techniques, and Procedures for The Field Artillery Cannon Battery. Washington, D.C.: Department of the Army, 20 November 1990.

U.S. Army. Final Draft Operational Requirements Documents (ORD) for the Advanced Field Artillery System (AFAS), and Future Armored Resupply Vehicle (FARV). Fort Sill, Oklahoma: Department of the Army, 14 June 1993.

U.S. Army. Special Text 6-50-60, Tactics, techniques and Procedures for the M109A6 (Paladin) Howitzer Section, Platoon, Battery, and Battalion. Fort Sill, Oklahoma: U.S. Army Field Artillery School, 3 June 1993.

U.S. Army. Technical Manual 43-0001-28, Army Ammunition Data Sheets: Artillery Ammunition Guns, Howitzers, Mortars, Recoilless Rifles, Grenade Launchers, and Artillery Fuzes. Washington, D.C.: Department of the Army, 30 August 1991.

U.S. Army. Training Circular 6-40A, Field Artillery Automated Cannon Gunnery. Washington, D.C.: Department of the Army, November 1989.

U.S. Army Field Artillery Center and School. Program and Project Summary Sheets. Fort Sill, OK: Directorate of Combat Developments, 1993.

Unpublished Theses

Buzon, C. Craig. "Operations Implications of 3X8 Field Artillery Battalions." Thesis, U.S. Naval Postgraduate School, 1990.

Finlon, Mathew A. "Analysis of the Field Artillery Battalion Organization Using a Markov Chain." Thesis, U.S. Naval Postgraduate School, 1991.

Government Studies

Military Professional Resources, Inc. Transition Of Future Cannon Artillery Study - II (TOFCAS-II). Alexandria, Virginia: Military Professional Resources, Inc., September 1993.

Tec-Masters, Inc and Advanced Systems Technology, Inc. Advanced Field Artillery System and Future Armored Resupply Vehicle Firing Battery, Platoon, and Section White Paper. Tactics, Techniques, and Procedures. Alexandria, Virginia: 30 July 1993.

Articles

Abrams, Creighton W., BG. "Field Artillery Desert Facts." Field Artillery Journal, (October 1991): 2-3.

Arntz, Stephen J., LTC. "'Roadrunner' (5th Battalion, 18th Field Artillery) Operations in Desert Storm." Field Artillery Journal, (June 1991): 35-39.

Ballagh, Robert S., Jr., COL. "Red Devil Redlegs: Fire Support in Operation Just Cause." Field Artillery Journal, (October 1990): 40-42.

Boatman, John. "UK Revises Artillery Tactics." International Defense Review, No. 25:7, (July 1992): 645-646.

Boatman, John. "AFAS Addresses Deficiencies in U.S. Artillery." International Defense Review, No. 25:6, (June 1992): 577-579.

Boyd, Morris J. "Focusing Combat Power - The Role of the Field Artillery Brigade (42d Field Artillery Brigade) in Desert Storm." Field Artillery Journal, (February 1992): 46-52.

Brown, William R., LTC. "NTC: Fire Support Trends and Fires." Field Artillery Journal, (December 1988): 48-53.

Crowder, W.E., MAJ. "Fire Support and Field Artillery Issues at Maneuver CTCs." Field Artillery Journal, (October 1992): 10-13.

Crowder, W.E., MAJ. "Platoon-Based Firing Battery Operations." Field Artillery Journal, (April 1991): 35-39.

Davis, Daniel L., 1LT. "Artillery in Action - The 2d ACR at the Battle of 72 Easting." Field Artillery Journal, (April 1992): 48-53.

Davis, M. Thomas, LTC. "Reflection on the Storm: FA Vector for the Future." Field Artillery Journal, (August 1993): 44-49.

Floris, John A., LTC. "1st Battalion, 41st Field Artillery in Desert Storm: A Test Bed for Doctrine and Development." Field Artillery Journal, (December 1991): 37-41.

Gass, James M., COL. "1st Cav Div Arty: Reports From Operation Desert Shield." Field Artillery Journal, (February 1991): 26-27.

Goodman, Glenn W., Jr. "U.S. Army Cannon Forced to Shoot and Scoot until 2003." Armed Forces Journal International, No. 129:2, (February 1992): 45-46.

Hallada, Raphael J., MG. "3X8: Our Force Multiplier." Field Artillery Journal, (February 1989): 1.

House, John M., MAJ. "Lessons from the Battlekings (3d Battalion, 41st Field Artillery) in the Desert." Field Artillery Journal, (October 1991): 16-21.

Ingram, Bernard L., CPT. ""3X8 and Beyond: Force Structure Changes for the Field Artillery of Tomorrow." Field Artillery Journal, (February 1989): 19-23.

Janowski, Ronald F., MAJ. "AOE (Army of Excellence) Force Structure and CONOPS (Contingency Operations)." Field Artillery Journal, (October 1988): 22-24.

Knight, Kenneth R., LTC and Larsen, Henry S., CPT; Batschelet, Allen W.; CPT; Hoskinson, Ronald A., CPT. "Movement to Contact: 'Red Dragons' in Operation Desert Shield." Field Artillery Journal, (June 1991): 42-45.

Lingamfelter, L. Scott, LTC. "In the Wake of a Storm: Improving the FA after Operation Desert Storm." Field Artillery Journal, (August 1991): 27-29.

Malone, Daniel K. "U.S. Army's Field Artillery Master Plan." International Defense Review, No. 22, (March 1989): 303-307.

O'Donnell, Thomas J., CPT. "3X8 Strategy: A Product Improvement." Field Artillery Journal, (February 1989): 15-18.

Pickler, John M., COL, and Gay, Mark P., MAJ. "3X8 Matures for Pathfinder Power." Field Artillery Journal, (February 1989): 24-27.

Quayle, T.D.G., MG. "Fighting the Field Artillery in the British Corps Battles of the 1990's." Field Artillery Journal, (February 1990): 25-30.

Rolston, David A., COL. "Victory Artillery in Operation Desert Shield." Field Artillery Journal, (April 1991): 23-25.

Turner, Albert F. Jr, LTC. "DS Artillery's Staff Planning Process - Adjustments for Success at the NTC." Field Artillery Journal, (October 1992): 33-37.

Van Loon, Henry. "Upgrading Field Artillery - A European View." Military Technology, No. 15:5, (May 1991): 45+.

Wroth, Mark B., MAJ. "Legal Mix VII - Direction for the Field Artillery." Field Artillery Journal, (December 1991): 42-48.

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